James McCosh

JAMES McCOSH.

1811-1894.

Young to the end, through sympathy with youth,
Gray man of learning! champion of truth!
Direct in rugged speech, alert in mind,
He felt his kinship with all human kind,
And never feared to trace development
Of high from low—assured and full content
That man paid homage to the Mind above,
Uplifted by the "Royal Law of Love."

The laws of nature that he loved to trace
Have worked, at last, to veil from us his face;
The dear old elms and ivy-covered walls
Will miss his presence, and the stately halls
His trumpet-voice. While in their joys
Sorrow will shadow those he called "my boys."

Robert Bridges '79.

November 17th, 1894.

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DOCTOR McCOSH.

The venerable ex-President of the College died on the sixteenth day of last November. He had been steadily failing during the summer and autumn and the end came peacefully and without pain. He is greatly missed: for while he had not taken a very active part in the affairs of the College since he resigned the Presidency in 1888, he continued to the last to feel a deep interest in the institution to which he had given twenty of the best years of his life. He never lost his enthusiasm for Philosophy and some of us will long remember a meeting of the Philosophical Club not more than a year ago, when he entered into the discussions of the evening with his old energy and alertness.

We shall never forget the debt which Princeton owes to Dr. McCosh. A great chapter in the history of the College was closed when he laid aside the burdens of his office and turned over the responsibilities of the Presidency to his successor. Beyond all question his was the most brilliant administration that Princeton has ever had. Everything contributed to add to the glory of that adminstration: the circumstances attending the Doctor's coming, the condition of the College when he came, what he was, and what he did. He found Princeton depleted by the war, yet already awakening to a new life. The money necessary for her equipment was ready and he came in time to give wise direction to its use. He brought to the service of the College, a high reputation as a thinker, a commanding personality, and ripe experience as an educator: and with a purpose that was never daunted he bent himself to the task of making Princeton one of the foremost seats of learning in America.

The death of Dr. McCosh was the close of a great career. His young manhood was spent amid the stirring scenes connected with the disruption of the Church of Scotland in 1843. He was a prominent champion of the intuitional philosophy in the days when Mill and Mansel were recognized leaders of opinion in Great Britain. Leaving the pastorate for a Professorship in Belfast, he became not only a great teacher of philosophy, but a public spirited student of educational questions. He came to America in the prime of manhood. As President of Princeton College he was enthusiastic, vigilant and wise. He loved the College. He loved his pupils. He had the rare gift of being able to kindle and keep alive in others that zeal for philosophy which was so characteristic of himself. He was hospitable to new ideas, yet zealous also for the maintenance of the great Christian verities that are woven into the entire web of our College history. He has placed the English-speaking world of

Evangelical Christendom under obligation to him for his defence of fundamental truth. To that world he was a Christian philosopher; but to us he was more than that, he was a Christian man—a reverent believer in the faith of his fathers and a humble follower of the Saviour. May his successors in the great office which he filled with such signal success ever have the liberal spirit, the strong convictions and the Christian faith which he possessed in such large degree!

It is not difficult to fix Dr. McCosh's place in philosophy. He had been a pupil of Chalmers, and was greatly influenced by Sir William Hamilton; and though he never occupied a chair in a Scottish University, his name should really follow next to Hamilton's in the History of the Scottish philosophy. Hamilton's successors can hardly be said to belong to this school. Fraser is too much of a Berkeleyan, and Seth though he has returned to a position more akin to Reid's than the one he occupied in the days of his Hegelianism is apparently aiming to represent the best elements in the replies of Reid and Kant respectively to the scepticism of Hume rather than the traditional Scottish philosophy.

For this infusion of German thought into Scotch Metaphysics, Dr. McCosh would say that Hamilton is in a great measure responsible, and it was the Kantian element in Hamilton's metaphysic that was the occasion of Dr. McCosh's first philosophical polemic. Dr. McCosh began his career as an author when he was a Free Church minister at Brechin, and the preface to the first edition of the *Divine Government* is dated 1850. It is not an uncommon thing for a great writer to embody an outline of all his subsequent thinking in his first book. Later books may be more elaborate, learned, scientific; they may take greater hold upon the public: but to one who makes a careful study of all that an author has written it will very often appear than in a few bold statements at the very beginning of his career he has outlined the entire system which in after life he has elaborated with such care and attention to detail. The *Divine Government* is probably not so much read now as it was a generation ago, but any one who is curious in such matters can easily satisfy himself that the great distinctive ideas which Dr. McCosh laboured with so much zeal to inculcate are all to be found in a germinal form in his first book. We may take his classification of the mental faculties, his doctrine of the intuitions and his distribution of them into three groups; his doctrine of perception and his theory of causation as illustrations of what we mean.

The *Divine Government* is a synthetic statement of the author's whole philosophy, and that philosophy was a theory of the universe conditioned by Christian revelation. It may be taken as in some respects the work which is most typical of Dr. McCosh, though it did not represent him in the maturity of his powers. It was a most important contribution to the literature of religious philosophy, and served a good purpose in antagonizing the views presented by Morell in his *Philosophy of Religion* which was very popular at the time of its appearance. If we are to understand Dr. McCosh and the influence he has exerted, we must think of him always as a Christian philosopher and a defender of the fundamental truths that underlie Christianity and, indeed, all religion. Even his book on the *Intuitions* which is perperhaps the best of his didactic treatises is really a piece of philosophical apologetic, and was so regarded by Dr. Shedd who wrote the preface to the first American edition.

Whether intuitions can be "inductively investigated" may perhaps admit of debate; but Dr. McCosh's position was well de-

fined, and he embodied it in the title to his book upon this subject. He never wavered in his belief in, and his devotion to the intuitional philosophy; and when in later years he presented his views to the public in the treatise on *First and Fundamental Principles*, he reaffirmed with fresh emphasis the positions which he had taken before. It is not to be denied that Dr. McCosh repeated some of his favorite ideas in several of his books. This was inevitable in a writer so voluminous as he was. And herein, indeed, lies, in no small degree, the secret of the great influence which he exerted. He had a message for this generation. He would not let men forget it; and he succeeded through industrious and indefatigable iteration in impressing himself upon the men of his time.

Dr. McCosh was a controversialist. It is perhaps safe to say that he appears at his best in his controversial writings. He wrote in strong, direct and forcible English. His meaning was always plain. He was never dull, and there was a naturalness in all that he wrote that constantly brought the image of the author to your mind as you read the printed page. He was a lover of nature, and saw it with the discriminating look of both the poet and the naturalist. Sometimes, especially in his didactic treatises, the reader feels that there is just a suggestion of the sermon. But all the best qualities of his style are seen in his polemic writings. His first contention was with Hamilton in regard to the relativity of knowledge. After that he had a tilt with Mansel. In later years he antagonized some of Spencer's positions, especially in regard to ethics; and when the celebration of the Kantian centenary filled the land with the deluge of Kantian literature Dr. McCosh appeared as an able and earnest opponent of the agnostic element in the Kantian philosophy. But perhaps the strongest and most effective piece of controversial work that Dr. McCosh ever did was his masterly *Examination of Mr. J. S. Mill's Philosophy, being a Defence of Fundamental Truth.*

Dr. McCosh, either as teacher or author, traversed the whole field of philosophy. He lectured for many years on the History of Philosophy, and his History of the Scottish philosophy is the authoritative treatise on that subject He wrote a short treatise on fundamental ethical problems and a valuable text-book on logic. His text-book on Psychology, which has been widely used in our colleges, was one of the first to recognize the conclusions reached by men like Wundt and Fechner, and to embody the results of recent studies in physiological psychology. He had his own classification of the powers of the mind, and in spite of what Professor Ladd has to say against the use of the word "faculties" in this connection, he would have seen no reason, we feel sure, for abandoning it. He did not teach "psychology without a soul," nor did he, on the other hand, give us such a discussion of what the word "soul" stands for as we find in the brilliant pages of Professor James. But he believed in the soul as something that knows and remembers, is immortal and can be saved or lost. He believed in immediate knowledge through the senses. He was thus—to use Sir William Hamilton's phrase—a natural Realist. He defended this realistic philosophy with religious earnestness, as being the only sure protection against agnosticism. Those who speak of Dr. McCosh's liberality and his sympathy with progressive thought must also remember that he was a firm believer in a certain type of philosophical orthodoxy, and that for this he was always ready to contend earnestly as for the faith once delivered unto the saints.

FRANCIS L. PATTON.

BIOGRAPHICAL NOTICE.

By ANDREW F. WEST.

[The information used for this notice comes from many sources, principally from members of Doctor McCosh's family, his pupils and friends in Great Britain and America, his own writings, and many scattered publications about him. This information has been used freely, perhaps even to the point of adopting some statements of fact and happy turns of expression without acknowledgment. Of the newspaper obituaries the best for his life in Scotland is to be found in *The Scotsman* of Edinburgh, under date of November 19th, 1894, (an account drawn largely from the volume on *Disruption Worthies* published in Edinburgh and London, 1881), the best for his Belfast life is in *The Northern Whig* of Belfast, November 19th, 1894, (based mainly upon information given by Mr. Thomas Sinclair of Belfast), and the best for his Princeton life appeared in the *New York Tribune*, November 17th, 1894. Interesting incidents of his relations to the students are in the *New York Herald* of November 18th, 1894. A good undergraduate estimate is to be found in the *Nassau Literary Magazine* for December 1894, and another in the number for June 1888. There is a sketch by the present writer in the *New York Observer* of November 22d, 1894, and a briefer one in the *Educational Review* for November, 1894. An article by Professor Ormond appears in the *Educational Review* for February 1895. Professor Sloane is editing Doctor McCosh's manuscript entitled "*Incidents of My Life in Three Countries*," soon to be published by Charles Scribner's Sons, New York.]

I.

Rarely has academic history repeated itself with such precision and emphasis as in the person of President James McCosh, who, though unique in his own generation, had a real prototype in the person of one, though only one, of his predecessors, President John Witherspoon, the ruler of Princeton a century ago. Each of them was in point of ancestry a Covenanter, by birth a Lowland Scotchman, in his youth a student at the University of Edinburgh, in his young manhood a minister of the Church of Scotland at a crisis of its history, and in that crisis an important figure,—Witherspoon heading the opposition to moderatism and Doctor McCosh helping to form the Free Church. When already past the meridian of life each of them came to America to do his greatest work as President of Princeton, the one arriving in 1768 and the other in 1868. Though of different degrees of eminence in different particulars, they were nevertheless of fundamentally the same character, being philosophers of reality, ministers of evangelical and yet catholic spirit, constructive and aggressive in temper, stimulating as teachers, stout upholders of disciplinary education, men of marked personal independence, of wide interest in public affairs and thoroughly patriotic as Americans. The principles of college government on which Witherspoon acted Doctor McCosh expressly avowed. "These principles," he wrote, "were full of wisdom, tact and kindness. Without knowing them till afterward, I have endeavored to act on the same principles, but more imperfectly. 'Govern,' said he, 'govern always, but beware of governing too much.'"* Their presidencies were long and successful. Each lived the last twenty-six years of his life in Princeton, and it may be noticed as a striking final coincidence that they passed away a century apart, almost to the day,—Witherspoon dying November 15th, 1794, and Doctor McCosh on November 16th, 1894.

* *John Witherspoon and his Times*, Philadelphia, 1890.

II.

James McCosh was born April 1st, 1811, at Carskeoch Farm, on the left bank of the "bonnie Doon," just above the village of Patna, some twelve miles from Ayr, the county town of Ayrshire. In this region, so full of inspiring Scottish memories, his boyhood was spent, and in common with so many of his countrymen who have risen to fame he received his first education in the parochial school. In 1824, when but thirteen years old, he entered the University of Glasgow, an institution already famous in the annals of the Scottish school of philosophy for the teaching of Reid and Hutcheson,—a fit place for the young student to begin, who was later to write the history of the Scottish School. Here he remained five years. In 1829 he entered the University of Edinburgh, coming under the influence of Thomas Chalmers and David Welsh in theology and of Sir William Hamilton in philosophy. He had also some strong intellectual compeers among the students of that time. Such, for example, were Tait, afterwards Archbishop of Canterbury, and the physicist, James Thompson, brother of Lord Kelvin. Incidents of Doctor McCosh's youth and student days formed the basis of many an interesting anecdote in his later years. Of such were his remembrances as a boy of the recurring anniversaries when his elders used to pledge with enthusiasm "the memory of Bobbie Burns." At other times he would dwell with fondness on one or another loved feature of the home scenery of Ayrshire or the talk of its people. The competition for intellectual honors at the University formed another theme. Then too, the strong impress of Sir William Hamilton's personality as well as of his teaching was one of those things that delighted his Princeton pupils to notice, especially as seen in the way he treasured some remark of his great teacher. "Do you know the greatest thing he ever said to me?" Doctor McCosh asked one day of the writer. "It was this: 'So reason as to have but one step between your premise and its conclusion.'" The syllogism unified and turned into a rule of conduct! Well might such a vigorous maxim take the imperative form. And how vividly real it made the act of reasoning seem. It was toward the close of his student days at Edinburgh that Doctor McCosh wrote his essay entitled "*The Stoic Philosophy*," in recognition of which the University, upon motion of Sir William Hamilton, conferred upon him the degree of Master of Arts.

III.

In 1835 he was licensed as a minister of the Established Church of Scotland. Toward the close of the same year he was elected by the members of the congregation, minister of the Abbey church of Arbroath, the "Fairport" of Sir Walter Scott's *Antiquary*, a flourishing town in Forfarshire, on the eastern coast, sixteen miles north of Dundee. While in this parish he made the acquaintance of the Reverend Thomas Guthrie, eight years his senior, the minister of the neighboring parish of Arbilot, and later so celebrated in the Old Greyfriars pulpit in Edinburgh. They were helpful to each other in their pastoral work and counsel, and formed the nucleus of a group of ministers who met to discuss with earnestness the impending dangers to the church, consequent upon "intrusion" by the Crown upon congregations of ministers irrespective of the preference of the people. They promptly identified themselves with the view that this subjection of the Church to the Crown was to be brought to an end, advocating, as Dr. McCosh had already done in his Edinburgh student days, what was known as Non-Intrusion. In 1838 on the suggestion of Doctor Welsh, his former teacher, Doctor McCosh was appointed by the Crown to the first charge of the church at Brechin, a short distance from Arbroath.

Brechin was an attractive old cathedral town with a large outlying country parish. In this arduous charge he labored most assiduously in company with his colleague the Rev. A. L. R. Foote. Besides attending to his stated church ministrations and the regular visiting of its congregation, he went abroad everywhere, preaching the Gospel in barns, kitchens and taverns, or in the open fields and wherever else he could do good.* His communion roll gradually swelled until it included fourteen hundred persons. Meanwhile the ecclesiastical sky was darkening. The Disruption of the Church of Scotland was impending, and when in 1843 it had become inevitable, Doctor McCosh in common with hundreds of other ministers, surrendered his living. He at once proceeded to organize in his old parish a congregation of the Free Church, into which over eight hundred of his former parishioners followed him. He also rendered great service at this crisis by organizing new congregations, providing them with preachers, raising money and getting sites for the erection of new churches. "A good horseman," says one of his best newspaper biographies,* "he rode long distances from place to place and preached in barns, ball-rooms or fields as was found necessary." In 1843 and the following year he was a member of one of the deputations appointed by the General Assembly to visit various parts of England and arouse Nonconformist interest in the position of the Free Church. In 1845 he was married at Brechin to Miss Isabella Guthrie, daughter of the physician, James Guthrie, and niece of Thomas Guthrie, his friend in his early ministry at Arbroath.

IV.

In this round of active life, with all its details and distractions, he kept alive his philosophical thinking, and in 1850 published at Edinburgh, his "*Method of the Divine Government, Physical and Moral.*" It was most favorably reviewed by Hugh Miller and commended by Sir William Hamilton. It brought him at once into prominence as a philosophic writer of force and clearness. The story goes that Earl Clarendon, then Lord Lieutenant of Ireland, sitting down to read a copy one Sunday morning, became so absorbed in the book that he missed going to church and read on till evening without stopping, and soon after offered Doctor McCosh the chair of logic and metaphysics in the newly founded Queen's College in Belfast. Doctor McCosh accepted the offer, removing to Belfast in 1852, and continuing there until he came to Princeton. His classroom was notable in many ways,—for his brilliant lecturing, his interesting method of questioning, his solicitude for his students and their enthusiasm for him. Besides fulfilling his regular duties he served as an examiner for the Queen's University of Ireland, as a member of the distinguished Board of Examiners who organized the first competitive examinations for the Civil Service of India, and as an examiner for the Ferguson Scholarships, open to graduates of Scottish Universities.* In 1858 he visited the principal schools and universities of Prussia, carefully acquainting himself with their organization and methods and publishing his opinions regarding them in 1859. It was at Belfast he brought out his *Examination of Mr. J. S. Mill's Philosophy; Typical Forms and Special Ends in Creation* (in conjunction with Professor George Dickie); *The Intuitions of the Mind*, and *The Supernatural in Relation to the Natural.* In his church relations he was both an

* *Disruption Worthies. A Memorial of 1843.* Edinburgh and London, 1881. The sketch of Dr. McCosh, written by Professor George Macloskie, is found on pp. 343-348.

† *The Scotsman*, Edinburgh, Nov. 19, 1894.

* *The Northern Whig*, Belfast, Nov. 19, 1894.

active promoter of evangelical piety and an efficient helper in ecclesiastical counsels. He helped to organize the Ministerial Support Fund of the Irish Presbyterian Church, seeking to evoke liberality and self-support in view of the coming disendowment. In the face of much opposition he advocated giving up the *Regium Donum*, or state bounty the church had been receiving. Arguments he used in this discussion were afterwards influential with Mr. Gladstone in connection with the disestablishment of the Church of Ireland. He advocated a system of intermediate schools to prepare for higher institutions of learning, and particularly labored for the great cause of a general system of national elementary schools. His own pupils attained marked success in the examinations for the Civil Service and some of them became very eminent,—one of them being Sir Robert Hart, the present Chief of the Chinese Customs Service. He was not a man who could be hid, and so there is little to wonder at in the distinction he earned, whether evidenced by the respect of men like Chalmers, Guthrie, Hugh Miller, Sir William Hamilton, Dean Mansel, the present Duke of Argyll and Mr. Gladstone, the kindly humor of Thackeray or the flings of Ruskin and sharp rejoinders of John Stuart Mill.

V.

Doctor McCosh paid his first visit to America in 1866, receiving a hearty welcome. In June, 1868, he was called to the Presidency of Princeton. He accepted the call after due deliberation, and arrived at Princeton October 22d of the same year. The story of the low condition of Princeton at that time, consequent upon the Civil War, does not need to be told here. So far as equipments and numbers can speak, the tale is soon told. Excepting a few professors' houses, there are now on the Campus only six buildings which were owned by the College when Doctor McCosh arrived. They are Nassau Hall, the old President's (now the Dean's) House, the Old Chapel, the College Offices, East College and West College. There were but sixteen instructors in the Faculty and about two hundred and fifty students. The institution was depleted, salaries were low, and academic standards had suffered, both in the way of scholarship and discipline. It was the low-water mark of Princeton's history, and the self-denial of the band of professors who went with the College through the war, has been only too slightly appreciated. The writer entered Princeton as a freshman in January, 1870, when the beginnings of Doctor McCosh's power were being manifested. His influence was like an electric shock, instantaneous, paralyzing to opposition and stimulating to all who were not paralyzed. Old student disorders were taken in hand and throttled after a hard struggle, out-door sports and gymnastics were developed as aids to academic order, strong professors were being added, the course of study was both deepened and widened, the ever-present energy of Doctor McCosh was daily in evidence, and great gifts were coming in. Every one felt the new life. When the Bonner–Marquand Gymnasium was opened, in 1870, the student cheering was enough to rend the roof. It was more than cheering for the new gymnasium,—it was for the new era.

VI.

It is not possible in this sketch to tell the story of the twenty years from 1868 to 1888, but the results may be indicated. The Campus was enlarged and converted into a splendid park, every detail of convenience and beauty being consulted in the transformation. The old walks, humorously named the "Maclean pavement," were replaced with something substantial,

grading and planting were carried out on an extensive scale, the drainage was remodelled, and many other such things, which seem small separately, but mean so much collectively, were attended to. The following buildings were added: The Halsted Observatory in 1869, the Gymnasium in 1869–70, Reunion Hall and Dickinson Hall in 1870, the Chancellor Green Library and the John C. Green School of Science in 1873, University Hall in 1876, Witherspoon Hall in 1877, the Observatory of Instruction in 1878, Murray Hall in 1879, Edwards Hall in 1880, the Marquand Chapel in 1881, the Biological Laboratory in 1887, and the Art Museum about the same time. The administrative side of the College was invigorated in many ways, a Dean being added to the executive officering in 1883. The Faculty was gradually built up by importation of professors from other institutions, and afterwards by training Princeton men as well. Twenty-four of Doctor McCosh's pupils are now in the Faculty. The course of study was revised and made modern, without giving up the historic essentials of liberal education. Elective studies were introduced and developed, and the relating of the elective to the prescribed studies in one harmonious system was always kept in view. To the old academic course of four years, leading to the degree of Bachelor of Arts, courses leading to the degree of Bachelor of Science and Civil Engineer were added, and graduate courses leading to the university degrees of Doctor of Philosophy and Doctor of Science were organized. The entrance requirements were improved in quality and were exacted with more firmness. The interior relations of the various departments of study to each other and to the general culture of the student were gradually better adjusted, and beginnings of specialized study founded on general culture were instituted. The use of the Library was made of importance as a help to the student's regular class work. The two literary societies, Whig and Clio, were relieved of the distress under which they had suffered from secret societies by exterminating these societies, and helped in their friendly rivalry by the establishment of additional college honors open to their competition. Old class-room and chapel disorders slowly gave way before better buildings and improved instruction. Useful auxiliaries to the curriculum were encouraged and, in particular, the President's "Library Meeting" was started. Here, month after month, the upper classmen met in large numbers to hear some paper by Doctor McCosh, some professor from Princeton or elsewhere, some bright alumnus or scholar unattached to a university. Distinguished strangers got into the habit of coming to see the College, and such visits as those of General Grant and other American dignitaries, and of the German professors Dorner and Christlieb, of the Duke of Argyll, of Froude and of Matthew Arnold were greatly enjoyed. And so by slowly-working agencies a change in the way of growth, now rapid and now apparently checked, was taking place. The impoverished small College was being renovated, uplifted and expanded. It was put on its way toward a university life. Its Faculty and students increased, until in 1888 the sixteen instructors had become a body of forty-three and the students were over six hundred. Yet this gratifying increase is not the great thing. It might have come and amounted to little more than a diffusion of weakness. But it was qualitative as well as quantitive, for the College was steadily producing a body of better and better trained men, and a body of men having an intense *esprit du corps* of great value for the future solidarity of Princeton. For Doctor McCosh not only left his indelible mark upon them singly, but fused their

youthful enthusiams into one mastering passion for Princeton as a coming university, democratic in its student life, moved by the ideas of discipline and duty, unified in its intellectual culture, open to new knowledge, and Christian to the core.

VII.

His relations with the students were intimate and based upon his fixed conviction that upon them ultimately rested the fate of Princeton. This conviction meant more than that he saw in young men the coming men. "A college depends," he once said, "not on its president or trustees or professors, but on the character of the students and the homes they come from. If these change nothing can stop the college changing." To his eyes the movement that determined everything was the movement from below upward and outward, and the business of president, trustees and professors was to make this mass of raw material into the best finished product possible,—but, first of all, the material must be sound if there is to be success in the product. The philosopher of elemental reality was never more true to his principles than just here. Given, however, a body of students of sound stock, and he felt sure that the desired results in their discipline and culture were obtainable by intelligent and patient treatment. First of all, as the negative condition of success, he insisted that idleness must be done away with or no progress would be possible. "If they are idle you can do nothing with them," was one of his axioms,—nothing to prevent the positive vices to which idleness gives occasion, and nothing to develop the mind by wholesome exercise. Next on his programme came an orderly and regular course of study to be pursued by the student without faltering. Then in order to bind all the student's life into one and place him in the right direction, he depended upon the sense of moral responsibility, quickened and energized by Christian truth. It was a simple programme, and great as it was simple.

His capacity for detail was marvelous, and hence he could meet special individual needs as well as plan on the general scale. It seems as though his sanity of judgment and constant endeavor to develop normal character was the very thing that enabled him to recognize the kind and extent of departure from the normal standard in any student at any stage of development. Once he met a rather pompous undergraduate who announced with some impressiveness that he could no longer stay in the church of his fathers, as he needed something more satisfying, and that he felt it proper to acquaint Doctor McCosh with the great fact. The sole reply was, "You'll do no such thing." And so it turned out. In answer to a cautiously-worded long question put by a member of the Faculty in order to discover whether some one charged with a certain duty had actually performed it, the answer came like a shot, "He did." No more! How short he could be! To an instructor in philosophy whom he wished to impress with the reality of the external world as against the teachings of idealism, he said with a sweep of his hand toward the horizon, "It is there, it is there! You know it! Teach it!" Then, too, he was shrewd. In case of a student who pleaded innocence, though his delinquency was apparent to the Doctor, who nevertheless wanted to be easy with him, the verdict was, "I accept your statement. Don't do so again." On one occasion a visiting clergyman conducting evening chapel service made an elaborate prayer, including in his petitions all the officers of the College, arranged in order, from President to trustees, professors and tutors. There was great applause at the last item. At the Faculty meeting imme-

diately after the service the Doctor, in commenting upon the disorder, aptly remarked, "He should have had more sense than to pray for the tutors." His consciousness of mastery was so naïve that he cared little for surface disorder in the classroom, so far as his confidence in being able to meet it was involved, but cared a great deal if he found himself at a dead point in the course over which he felt he must carry the class. Here the dullards, the apathetic, the drones, the light-witted and especially the provokers of disorder came in for a castigation of the most interesting kind. "Sit down, sir," sometimes served both to suppress a tumult and at the same time waken a mind that had never been awake before. He could talk to men with a severity and tone of command few would dare employ. Though the most indifferent could not fail to see that he was terribly in earnest at times, they also saw his hearty and deep affection for them. "A man of granite with the heart of a child" is an undergraduate's estimate of the old Doctor.

A pleasant picture of the impression he made on another man of simple heart and strong nature is preserved in a letter of President Mark Hopkins, of Williams College, written after Doctor McCosh had visited Williamstown. It may well be inserted here. "That visit," he writes, "is among my most pleasant recollections. It was during the summer vacation; the weather was fine, and we were quite at leisure to stroll about the grounds and ride over the hills. Riding thus we reached, I remember, a point which he said reminded him of Scotland. There we alighted. At once he bounded into the field like a young man, passed up the hillside, and, casting himself at full length under a shade, gave himself up for a time to the associations and inspiration of the scene. I seem to see him now, a man of world-wide reputation, lying thus solitary among the hills. They were draped in a dreamy haze suggestive of poetic inspiration, and, from his quiet but evidently intense enjoyment, he might well, if he had not been a great metaphysician, have been taken for a great poet. And, indeed, though he had revealed himself chiefly on the metaphysical side, it was evident that he shared largely in that happy temperament of which Shakespeare and Tennyson are the best examples, in which metaphysics and poetry seem to be fused into one and become identical."*

About his personality numberless stories have gathered, illustrative of his various traits. He was the constant theme of student talk, even to his slightest peculiarities. The "young barbarians all at play" were fond of these, and yet with reverence for him. Who can forget the various classroom and chapel incidents? Who will ever forget some of the Doctor's favorite hymns? No one, surely, who heard two of them sung with deep tenderness at his burial.

VIII.

Doctor McCosh gave up the presidency June 20th, 1888, passing the remainder of his days at his newly-built home on Prospect Avenue. His figure was well known among us these last years, as he took his walks in the village, or out into the country or under the elms of the McCosh Walk, or sat in his place in the Marquand Chapel. His interest in the College never abated. Yet he did not interfere in it after he left it. As President Patton has observed: "He was more than a model President. He was a model ex-President." Nor did he lose sight of "my boys," his former pupils. At the annual reunions of classes it became the custom to march in a body to see him at his home. He "knew them," even if not always by

*New York *Observer*, Thursday, May 13, 1869.

name. Yet he would astonish many a one by recalling some personal incident that might well be supposed to be forgotten. Nearly one hundred and twenty of his pupils have followed his example in devoting themselves to the cause of the higher learning. Some of them may have failed to follow the old Doctor's philosophy in all its bearings, some may have diverged otherwise, but no one, I feel sure, has failed to carry away a conviction of the reality of truth and of the nobility of pursuing it, as well as at least a reverence for the Christian religion. On April 1st, 1891, his eightieth birthday occurred. It was duly honored.* The day was literally given over to the old Doctor. The President, the Trustees, the Faculty as a body, the students, the alumni, the residents of Princeton and distant personal friends were all present or represented. His last really public appearance was at the International Congress of Education held in connection with the World's Columbian Exhibition at Chicago in July, 1893. The popular interest and the interest of educators in him was such as to make him the most noted figure there. Other Presidents and institutions joined cordially in doing him honor, and his presence at the Princeton section of the university exhibits was the occasion for a demonstration of affection from his old pupils.

On Sunday, October 28th, 1894, he was as usual in his place in the Chapel. It was his last appearance there. Within a day or two he gave such evidence of failing strength that his end was seen to be near. Without the stroke of disease, clear-minded to the last, at his own home and surrounded by all his family, he peacefully passed away at ten o'clock in the night of Friday, November 16th, 1894. The students whom he had never taught, but who loved him, rang the bell of Nassau Hall to tell Princeton that Doctor McCosh was dead.

Fortis vir sapiensque is part of the epitaph of one of the Scipios. It describes Doctor McCosh. But he was more than a strong and wise man. He discerned so far as to distinguish between the transient and the enduring, the illusory and the real, in character, in thought, in education and in religion. He sought and laid hold on "the things that cannot be shaken." And they will "remain." For, as one of his pupils well said when we turned home from his grave, "He was himself one of the evidences of the Christian religion."

* See *Harper's Weekly*, April, 1891.

THE FUNERAL EXERCISES.

By WILLIAM LIBBEY, Jr.

The fine weather of Tuesday, November 20th, made it possible to carry out the arrangements which had been made for the last honors to our beloved ex-president. These arrangements were prepared by a committee of the Faculty consisting of Professors Libbey, Sloane and West, and were executed by Professor Libbey as marshal. Special trains from both New York and Philadelphia brought large numbers of alumni and friends to pay their tribute to his memory.

Marquand Chapel had been appropriately draped and decorated with plants and flowers under the supervision of a committee of the Faculty, consisting of Professors Marquand and Frothingham. In addition, the entrance to Nassau Hall had been heavily draped and the national colors above placed at half-mast. The buildings of the two Literary Societies had also placed the emblems of mourning over their portals.

At 1:30 P. M. the bell of Nassau Hall called the invited guests, the Trustees of the College and Seminary, and the Facul-

ties of both institutions together in the Old Chapel. Here they were formed in line by Professor Magie and proceeded to Marquand Chapel. The choir of the chapel had been reserved for this procession, with the exception of the College Faculty who occupied the stalls upon both sides of the building. The general seating arrangements of the chapel had been placed in the hands of Mr. Harold McCormick as grand usher. The middle block of seats was occupied by the family and personal friends, and the side blocks by the alumni. In the meantime, the College students, 1,000 strong, had assembled at the eastern end of Nassau Hall under their marshals as follows: Grand marshal, Stanley McCormick; senior marshal, James Blair, Jr.; junior marshal, A. Gunster; sophomore marshal, J. M. Hitzrot; freshman marshal, A. M. Stewart. After forming they marched in double ranks past the chapel, and through McCosh walk to Prospect avenue. Upon reaching the late residence of Dr. McCosh the ranks divided and took up positions upon the two sidewalks, the lines reaching from the gateway of the house to Washington street. Brief services had already been conducted by Professor Macloskie in Dr. McCosh's study in the presence of the immediate family. Upon their conclusion the funeral cortege, consisting of the hearse and the three carriages containing the members of the family, passed down the avenue between the student ranks. The pall-bearers, Professors Fine, Marquand, Ormond, Osborn, Scott, Sloane, Winans and West, walked on either side of the hearse. When the hearse had reached the head of the line, the students marched with it as a guard of honor to the chapel. As the procession passed through the gates at the end of McCosh walk the bell began tolling and continued to toll until the chapel doors were closed. As the casket entered the chapel, carried by his former pupils, Professor Dwight Elmendorf '82 played Guilmant's "Prayer." Mrs. McCosh, upon the arm of her son, Dr. Andrew J. McCosh of New York, followed the coffin up the aisle while immediately behind them were Mr. and Mrs. Maitland and Dr. and Mrs. Magie. President Patton presided at the exercises in the chapel, and announced the favorite hymn of Dr. McCosh, which was sung by the whole congregation to the tune "Dundee,"

O God of Bethel! by whose hand
Thy people still are fed;
Who, through this weary pilgrimage
Hast all our fathers led;

Our vows, our prayers, we now present
Before thy throne of grace:
God of our fathers! be the God
Of their succeeding race.

Through each perplexing path of life
Our wandering footsteps guide;
Give us this day our daily bread,
And raiment fit provide.

Oh, spread thy covering wings around,
Till all our wanderings cease,
And at our Father's loved abode
Our souls arrive in peace.

President Patton then read selections from both the Old and New Testaments.

The following address was then delivered by Dean Murray:

A great career has been nobly fulfilled, the conflicts ended, the course finished, the faith kept, its closing scenes have been all ended by every circumstance of welcome alleviation, the mind clear to the last, the death itself a painless sinking into rest, not one of that dear innermost circle absent from the home, it surely seems that a triumphal rather than a mournful note should be struck. It seems that

"Nothing is here for tears, nothing to wail,
Or knock the breast, no weakness, no contempt,
Dispraise or blame, nothing but well and fair
And what may quiet us in a death so noble."

Yet grief there must be, nothing can wholly remove that pang of parting. But

grief is so blended and tempered with a sacred joy that we to-day are of those described by an apostle as "sorrowful yet always rejoicing."

It sometimes happens, indeed, in the rushing energy of life that when a man who has held high position and achieved great usefulness retires from his field of active labor and having laid down strenuous service for the more secluded life of contemplation and rest, is no more so prominent in the public eye, that for the time at least his great success becomes dimmed to view. The busy world soon forgets the most stirring and prominent. But to this Dr. McCosh was a marked exception. Not for a moment, since six years ago he resigned his presidential office and has lived among us as citizen and neighbor and friend, not for a moment has his work here been forgotten. His appearance on any public occasion, his words whenever uttered, always drew that hearty, enthusiastic response which at once revealed how vivid and how strong was the appreciation of what he had done for, what he had been to, this institution. Not less than when he put off his official robes was this sense of indebtedness to him, on the part of every student, every graduate, every friend of the College, every friend of the higher education.

But he has now passed away. We shall see him no more under the elms, along the path which bears his name, no more a glad and reverent worshipper in this chapel. Yet, if it were possible, his death, the absence, the silence, has by a sort of shock roused a larger appreciation, a fuller sense of the work he did in the twenty years of active presidential service, and like

> "Mists that rise against the sun
> Made him but greater seem, not greater grow."

It is not, however, on this occasion for me to attempt any estimate of Dr. McCosh's life-long devotion to philosophic studies, any formal survey of what he was as an educator, to give any full detail of what he did for this institution. That will be done on some future occasion and by hands more competent than mine to take just measurements of his achievements. My task is the grateful but simple one of saying a few words which may indicate our sense of loss and also of high appreciation, may evoke our gratitude to God for His gift of the man to us ere we lay him down in yonder cemetery by the side of his great compeers, Jonathan Edwards and John Witherspoon.

Dr. McCosh assumed the Presidency in the Autumn of 1868. It was noticeable how immediately he made the impression that under his control the College was to rise into a prominence it had never before attained. I was at that time a pastor in New York City, but I well remember how in influential circles there, outside the nearer constituency of the institution, it was felt that under divine Providence a new and brilliant chapter in Princeton's history would be written. An inquiry into what such a conviction was founded on would recognize first of all the reputation he had already achieved in Great Britain. He had been selected as one of the examiners for the Civil Service and had distinguished himself by the skill and ability with which he had fulfilled the duties of this public position. He had in Queen's College, Belfast, for years borne a high reputation for his abilities in the Professor's chair.

He had gained name and fame by his writings, especially by his work on *The Method of the Divine Government.* For this success abroad as well as for his later success here, he had secured a mental training and discipline in the University of Edinboro', which was thorough and broad, and during his pastorate he had maintained the habits of a close and enthusiastic student.

Thus trained and with the prestige already secured, of a distinguished educator, he began his work here. The fortunes of the College were at a low ebb. There were noble foundations in its historic past on which he could build. There were noble benefactors, especially our founder, John C. Green, ready to second his efforts with noble gifts. And we can only realize what he was as a College president when to-day we recall what his twenty years of service for the College accomplished.

It is doubtful whether his success could have been so great, certainly not so complete, but for the influence he at once gained as a leader, and as a teacher of philosophy. It is no disparagement to those who had gone before him in this department to say that never had Princeton known such power in that chair. Jonathan Edwards, the greatest name in American philosophy, was president of the College but for six short weeks. But Dr. McCosh had not been long in this chair before he had roused an enthusiasm for philosophic study which has borne wide fruits. This influence as a teacher kindled the admiration of his pupils, and as class after class went from under him they bore into the communities they represented the same confidence in his abilities, the same pride in his attainments, and all this lent a subtle but decisive aid to his efforts in re-organizing the College and building it up along the new lines. And therefore Dr. McCosh is an illustration of the truth which I fear this age is in danger of forgetting or too lightly heeding, that a college president can only reach the fullness of possibilities in his great office when to the organizing and executive functions he can add that of a great teacher in a great department of knowledge, be it scientific, philosophic or literary.

Such names as that of the late Master of Balliol, those of Francis Wayland, Mark Hopkins, Theodore Woolsey and James McCosh are at once the brilliant illustrations and cogent proof of this truth.

Aside from these general qualities which so strongly characterized the presidency of Dr. McCosh, these more special elements may be named as leading features. There was in him a concentration of all his resources for building up the College. No one could come even into casual contact with him without perceiving how entirely this purpose possessed him. When he lay down and when he rose up, at home or abroad, in social circles or in public circles, those about him were made to feel that the one great aim filling the horizon of his thought and feeling was the advancement of the College. He never spared himself. No journey was too long to be taken, no sacrifice was too great of time or effort, no call from the alumni or friends of the institution too exacting. The wonder was that with all these outside efforts he kept up resolutely and continuously his studies. We used to smile sometimes at the naïve way in which he would speak of *my college*. But if we thought deeply enough upon the quaint phrase, we saw that this sense of proprietorship meant with him that he had identified all *his* interests with those of Princeton, they were not two but one. He laid all his gifts and labors willingly on the altar of devotion to her interests. And if in all this he seemed to know but one thing and that the growth of *his* college, let us to-day remember that this is the secret of all high success in any department of life.

The breadth of his educational spirit also enters as a characteristic feature of his administration. Dr. McCosh believed profoundly in the old-time classical training. He never swerved from this position. Had he been asked the question, Can one not get an education without Greek, he would have answered, "Yes! an education, perhaps a good education, but never the best." Yet

he was no doctrinaire. He kept himself in touch with all modern educational methods, made them his study, took from them what his judgment approved as wise mental discipline. He had a large recognition for modern science, had no fear of it as anti-Christian, owned its disciplinary power, and sought to have the spirit and methods of Joseph Henry perpetuated here in large measure. And so from year to year the curriculum was broadened under him, its standards raised, and nothing of exact and thorough mental discipline sacrificed. The whole College felt this. His students caught this spirit. His Faculty owned its worth. And thus he rallied to the support of the institution that large and growing class of men who are demanding in education as in every thing else, a recognition of the modern spirit.

Nothing, however, is more to be reckoned among the elements of Dr. McCosh's power than his personal relation to the students. Their pride in him, their enthusiastic recognition of the growth of the College under him was not more marked than their personal affection for him. This grew on after they had ceased to be his pupils and had gone out into life. If one seeks to analyze its sources, it may be difficult to specify one quality more than another. Sometimes it was wakened by a word or two of kindly interest in the library, or of friendly greeting on the campus. If, as some of you may recall, there was a slight haze of uncertainty about the name, there was no uncertainty about the kindly feeling in his heart toward you as one of "my pupils." He was never unapproachable. How kind he was in sickness! That always touched him. I never saw him unnerved but once and that was in the dreadful sickness of 1880. Meeting him on the campus, I had to tell him of one case peculiar in its distressing circumstances. He seemed dazed by his grief. It was too deep for words. The project of a College Infirmary was a favorite one with him. When he learned a few years ago that it was at last to be fulfilled, his joy was great. He was a liberal contributor toward its erection, and those who heard his prayer at the laying of the corner stone of the infirmary will recall how tenderly he alluded to the sick student away from home and friends.

I should sadly fail in doing any justice to the memory of Dr. McCosh did I not lay a special emphasis on the Christian element in his administration. Amid all his high ambitions and large plans and unsparing labors for the College, he never forgot, and his Faculty was never allowed to forget, that it should maintain the character and do the work of a Christian college. He believed profoundly that education must have a Christian basis. He was loyal to all the traditions of the past, and he sought to administer the office he held in the spirit of its noble charter. It was under his guidance that the practice of administering the Holy Communion at the beginning and close of the College year was instituted. It was to him a source of the truest joy when this beautiful chapel was reared by the generosity of its donor. He wrote the graceful inscription on yonder tablet. In private and in public, in active co-operation with the Christian Society of the College, in many a confidential talk with his students on the great themes of religion, he sought always to develope the Christian element in College life. I do not think he favored the idea of a College Church. In fact, though a Presbyterian by deep conviction, he avoided anything which would divert attention from his own aim to make the College Christian rather than denominational. The catholicity of his spirit here was full and large. The legacy of devotion to the Christian element in College life he has left us is indeed a sacred and abiding one.

And I must not omit a passing allusion to the debt which the Christian ministry owes him. Dr. McCosh never forgot that he had been himself a pastor. He delighted to refer to his work in the parishes he had served in his beloved Scotland. His pride in the part he took, along with Chalmers and Guthrie and the host of Scotch worthies in establishing the Free Church of Scotland was with him always. In his latest days his eye would kindle over the recollection of those memorable scenes in the ecclesiastical history of Scotland.

It was noticeable, too, how deep was his interest in all the modern movements of the Christian Church to bring the gospel of Christ to the poorer classes. Nay, to have the Christian Church brought into closer connection with them. How profoundly he deplored their absence and separation from the ordinances of the gospel. Some of his most striking public utterances are in connection with this mighty problem.

Aside from this power of example, he has laid the Christian ministry under lasting debt by his writings. I was a young pastor when his noble book on *The Method of the Divine Government* came out, but I well remember the delight with which it was hailed by the generation of young ministers then on the stage. And the assertion may be safely ventured that if the libraries of the American ministry could be searched it would be a gratification if not a surprise to find how large a place Dr. McCosh's works fill upon their shelves.

The last address by Dr. McCosh in this chapel was a memorable one. It was given several years ago on a Sunday evening in the simple religious service held here in the close of the day. He had been asked repeatedly once more to preach in the pulpit, from which he had so often spoken, but had declined from a fear that he might not be able to endure the strain. This simple and less exhausting service he readily undertook.

On the occasion to which I refer he read, with a touching emphasis, St. Paul's 13th Chapter of First Corinthians, that wonderful chapter in which the apostle discourses on Charity. Having ended the reading, he gave a brief analysis of its points, remarking on the great climax of the last verse, "And now abideth Faith, Hope and Charity, but the greatest of these is Charity." Then he announced his purpose of saying a few words on the first clause of the 9th verse, and read it slowly, and those who heard it will not forget the scene as he said, " For we know in part," instantly adding with an almost triumphant tone, " But we know."

Six years ago he laid aside the cares of office and entered on the evening of his life, followed by the gratitude of his pupils, the admiration of his friends, and the good wishes and kindly thoughts of all who had been associated with him in the Faculty or Board of Trustees. His retirement was characterized by an equal dignity and cheerfulness. He had always been a busy student, and he still kept up the long-cherished habits. It was his delight to welcome his old students at his home. His interest in the College was as deep and devoted as ever. His pen was not idle, and his brain wrought on with no sign of diminished vigor. At last, however, the vigorous form began to succumb. The decay of physical power was very gradual. He could no longer take the accustomed long walks in which he delighted. The seat was provided under yonder elms where many of us have seen him resting. There let it remain till it has crumbled to dust.

A few months since it became apparent that old age was slowly but surely sapping the foundations of his vital strength. The outward man was perishing, but the in-

ward man seemed renewed day by day. Tis but a few weeks since, that on a Sunday morning he was a worshipper with us in this chapel. The end, however, was just approaching. He was soon thereafter confined to his bed. Of late he had begun to feel that his physical weakness had closed on him the gates of useful life and the thought saddened him.

The last illness was, however, brief and painless almost to the last, but consciousness was entire, his mind clear, till he fell asleep, having served his generation by the will of God. He was ready to depart and be with Christ. Once when his beloved wife repeated to him the tender words, "God so loved the world that He gave His only begotten Son, &c.," the prompt and touching response was, "Praise His grace." At another time the hymn of Bonar, "I bless the Christ of God," was read to him and its reading gave him evident comfort. It may well stand as the confession of his faith.

And so he has passed away.

There is no class of public men who, in the development of American institutions with their new and complex problems, have fulfilled a nobler work than the presidents of our colleges. They have been men of the best type of Christian culture. Their personal influence, their teaching have largely moulded the character of those who touch the springs of national life and give shape to our American civilization. Their work may not have been sufficiently recognized. But the educator as a power in American life, growing year by year, must be reckoned with always, and as it comes to be measured more justly, the men who have risen to the height of their noble trusts, as heads of the higher seats of learning, will find a grateful country ready to give them their due meed of praise. Among these names, and high among them, will be found that of Dr. James McCosh. Let this one last word be one of deep and reverent thankfulness to the God of our fathers for His gift to us of this honored president whose mortal body we shall soon tenderly carry to its burial.

Rev. Dr. Henry van Dyke of New York then delivered the following address as the representative of the alumni:

"The duty which falls to me to-day is very simple and very sacred. A member of the first class that entered Princeton under the Presidency of Dr. McCosh, I am called here to speak not for myself alone, but in the name of two thousand old pupils who would pay the tribute of honor and love to the memory of our grand old man. We loved him because he loved Princeton. He was born in Scotland, but he was born an American and Princetonian. If you could have opened his heart, you would have found 'Princeton' written there. He was firmly convinced that this college, with its history, its traditions, and its Christian faith, was predestinated to become one of the great American universities. 'It is the will of God,' he said, 'and I will do it.' A noble man, with a noble purpose, makes noble friends. Enthusiasm is contagious. Dr. McCosh laid the foundation of Princeton University broad and deep and strong; and he left behind him a heritage of enthusiasm, a Princeton spirit which will complete his work and never suffer it to fail. We love him because he loved truth, and welcomed it from whatever quarter of the wide heaven it might come. He had great confidence in God as the source of truth and the eternal defender of His true word. He did not conceive that anything would be discovered which God had not made. He did not suppose that anything would be evolved which God had not intended from the beginning. The value of his philosophy of common sense was very great. But he taught his students something far

more precious—to love reality in religion as in science, to respect all honest work, and to reverence every fact of nature and consciousness as a veritable revelation from Almighty God.

"We loved him because he loved us. He could not always call our names, but he always 'knew *us* very well indeed.' He knew that we were his boys. He sympathized with us in our disappointments. He was glad when anything good came to us. He was proud of those of you who have won honors. He honestly and warmly desired the temporal and eternal welfare of every one of his students. And so to-day the hearts of men all over this country, yes, and all around the world, are turning to this place with thoughts of sorrow, and pride, and loyal love.

'O good gray head, which all men knew, * * *
O iron nerve to true occasion true,
O fallen at length that tower of strength
Which stood four-square to all the winds that blew.'

"But what of Dr. McCosh as a minister of Christ? It has been said that he was not a great preacher. Judged by an academic standard, perhaps he was not. But he was a great *man*. His character was a sermon. His life of action was sacred eloquence. His old age of peaceful, genial, mellow beauty was like the benediction 'that follows after prayer.'

"Farewell, beloved man of God and master of our youth; gratefully, affectionately, triumphantly we bid you farewell. You have fought a good fight; you have finished your course; you have kept the faith; you have received the crown of life from your Redeemer's hand. We would leave at your feet the unfading wreath of your old students' honor and love."

Rev. Dr. John Hall, of New York, then led in prayer as follows:

Almighty God, our Heavenly Father, we pray for the sake of Jesus Christ thy Son thou wilt give unto us thy presence and teaching and divine example. We adore thee, blessed Father. We recognize thee as all wise and all holy. We worship thee through Christ our Redeemer. We thank thee that thou didst give this man. We trust in thee and put our souls in thy keeping. We thank thee for his faithfulness in thy work. All this has been owing to thy grace, Oh Lord, and we give thee the glory. Let thy peace rest upon this institution and all other colleges. Let thy aid be extended to all forms of Christ's work until we meet in the great general assembly. These great blessings we ask for ourselves and others. And now may the great Shepherd of the sheep make us perfect unto death, as he was, through Jesus Christ, to whom be the glory for ever and ever. Amen.

The following hymn, which was written by Horatius Bonar, a great friend of the late Doctor McCosh, was then sung:

I bless the Christ of God:
I rest on love divine;
And with unfaltering lip and heart
I call this Saviour mine.

His cross dispels each doubt;
I bury in his tomb
Each thought of unbelief and fear,
Each lingering shade of gloom.

I praise the God of grace;
I trust his truth and might;
He calls me his, I call him mine,
My God, my joy, my light.

'Tis he who saveth me,
And freely pardon gives!
I love because he loveth me,
I live because he lives.

My life with him is hid,
My death has passed away,
My clouds have melted into light,
My midnight into day.

The benediction was pronounced by Professor Duffield: And now may the peace of God, which passeth all understanding, keep our hearts through Christ Jesus. May the grace of our Lord Jesus Christ, the love of God, the communion of the Holy Spirit, be with us all for ever. Amen.

At a quarter past three, when the services in the Chapel were over, the procession formed in the following order to proceed to the grave:

Marshals.
Students of the College.
Students of Seminary.
Clergy in Carriages.
Pall Bearers.
Hearse.
Family in Carriages.
Invited Guests in Carriages.
Trustees of the College and Seminary.
Alumni by Classes.
Mayor and Council of Princeton.
Citizens.

Upon reaching the grave, which lies at the head of the eastern side of the President's plot, the students of the College formed three sides of a hollow square and the Seminary students occupied the fourth side. Within this square stood the clergy, family, the invited guests, trustees and faculties of the College and Seminary and the alumni.

The services at the grave were conducted by President Patton, who prayed as follows:

Almighty God, our Heavenly Father, Thou hast said that whosoever loved and believed in Thee should never die, and as we look at this open grave we sorrow not as those who have no hope.

He was our leader, our teacher, and we thank Thee for his life. We thank Thee for the many deeds of Christian service and for his peaceful, quiet end.

And now we come ourselves to Thee, imploring that we, too, may follow him as he followed Christ, and that we may be active and earnest in the great cause of truth. Oh, grant, Heavenly Father, that we may be faithful unto death and that we may receive the crown of glory.

And now unto Him who washed us in his own blood, we would say, Glory unto him, forever and ever. Amen.

The Rev. Dr. Hinsdale then pronounced the benediction.

Among the invited guests from other institutions and public bodies who attended the funeral were Hon. William T. Harris, United States Commissioner of Education, Washington; President Dwight, of Yale University; President Gilman, of Johns Hopkins University; Mr. C. C. Beaman and Mr. Francis H. Rawle, of the Overseers of Harvard University; Provost Harrison, of the University of Pennsylvania; Rev. Dr. Hastings, of Union Theological Seminary; President Austin Scott, of Rutgers College; President Warfield, of Lafayette College; President Hewitt, of Emporia College, Kansas; Professor Palmer, of Harvard University; Mr. G. A. Plimpton, of the Trustees of Amherst College; Professor Armstrong, of Wesleyan University; Dr. J. C. Mackenzie, the Headmaster, and the masters of the Lawrenceville School; Governor Werts of New Jersey and his staff.

FACULTY RESOLUTIONS UPON THE DEATH OF DR. McCOSH.

At a special meeting of the Faculty, held Saturday noon, November 17th, 1894, President Patton appointed Professors Shields, Duffield, Ormond and West a committee to prepare a minute upon the death of Doctor McCosh. Accordingly the following minute was prepared and was subsequently adopted by the Faculty and ordered entered upon the record.

"In recording the death of President McCosh, the Faculty are not able to give

adequate expression to their feeling. For many years their relations with him were closer than those of any other portion of the Academic body; and their continued friendship with him since his retirement from office has only deepened the sense of bereavement and increased the veneration and love with which they have followed him to his grave.

While presiding in the Faculty Dr. McCosh always commanded respect by his conscientious devotion to the interests of the College; by his fidelity in the routine of official duty; by his watchful supervision of the details of the whole administration; by his kindly interest in the labors of his colleagues; by his hospitable welcome to every new study and new teacher; by the wisdom and liberality of his plans for expanding the courses of instruction; and the wonderful efficiency and success with which he carried these plans toward completion.

The results of his Presidency have made a new epoch in our history. The College has virtually become a University. Its Faculty has been trebled in numbers. Its alumni and friends have rallied around it with new loyalty. Munificent gifts have been poured into its treasury. Schools of Science, of Philosophy, of Art, of Civil and Electrical Engineering have been founded, with endowed professorships, fellowships and prizes, and an ample equipment of libraries, museums, laboratories, observatories, chapels, dormitories, academic halls and athletic grounds and buildings. We live amid architectural monuments of his energy, which other College generations after us will continue to admire.

In his own department of instruction Dr. McCosh has raised the College to its proper eminence as a seat of philosophical culture. He did this primarily as a thinker, by original contributions to Logic, to Metaphysics, to Psychology, to Ethics, and to the Intuitional School of Philosophy; also as a writer, by the numerous works, written in a strong and clear style, with which he has enriched the philosophical literature of his time; and especially, as an inspiring teacher, by training enthusiastic disciples, who are now perpetuating his influence in various institutions of learning. From this Faculty alone a band of such disciples has borne him reverently to his burial.

In the sphere of College discipline Dr. McCosh aimed at the moral training of the whole undergraduate community. The students were brought into more normal relations with the Faculty. Vicious traditions and customs among them were uprooted. Their self-government was guarded and promoted; and their religious life found fuller expression in the new Marquand Chapel, Murray Hall and the St. Paul's Society.

In the cause of the higher education Dr. McCosh became a leader at once conservative and progressive. On the one hand he sought to retain the classics for their disciplinal value and as fundamental to the learned professions and all true scholarship; and for like reasons, the mathematics as essential to the sciences, whether pursued as bodies of pure knowledge or applied in the arts. But on the other hand, he found due place for the host of new special studies, literary, historical, political, artistic, technical, demanded by modern life and culture. His inaugural address "On Academic Teaching in Europe" may be said to have struck the keynote of true academic teaching in America.

As the representative head of the College, President McCosh was always and everywhere faithful to its Christian traditions. By his writings, lectures and addresses he defended "Fundamental Truth" in religion no less than in philosophy; he vindicated the "Method of the Divine Government" physical as well as moral; he

set forth the "Typical Forms and Special Ends in Creation" as consistent with evolution; he showed the analogy of "The Natural and the Supernatural"; and he maintained a logical "Realism" and "Theism" against the growing scepticism of the day. At the same time his discriminating conservatism was ever held in hearty sympathy with the modern scientific spirit, and his steadfast adherence to the principles of evangelical religion never narrowed his Christian sympathies. A leader in great international Alliances and Councils of the Churches, he also consistently welcomed students of every religious denomination to their chartered privileges within our walls. The representatives of all creeds mingled in his funeral.

While a commanding figure has passed from public view there remains among us, who were his nearer associates, the charm of a unique personality and rare Christian character, to be henceforth enshrined in our memories with reverence and affection.

To his bereaved family we can only tender our deepest sympathy, praying that they may receive those divine consolations, which he himself taught during his life and illustrated in peaceful death."

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By JOSEPH H. DULLES.

The following list covers a period of sixty-one years, from the time that Doctor McCosh was twenty-two years old until the year of his death. It is arranged chronologically and thus constitutes an exposé of his literary life. The absolute chronological sequence is broken in the cases of the Baccalaureate Sermons and the Philosophical Series, which are kept together. The list does not include all of Dr. McCosh's contributions to the religious press, but does contain the more important of these. It embraces three classes: books, papers read before learned societies and articles contributed to various periodicals, and distinct pamphlets. The books may be distinguished by small capitals. The pamphlets are given as bound in paper, although in one or two cases there is no separate cover. *Italics* have been used to indicate the periodicals or published proceedings in which his various articles have appeared.

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James C. Welling

Princeton College Bulletin.

EDITED BY THE PRESIDENT AND MEMBERS OF THE FACULTY.

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PRESIDENT JAMES C. WELLING, LL.D.

James Clarke Welling, graduate of the class of 1844, and professor in 1870, was born in Trenton, N. J., on July 14, 1825.

While in college he attained distinction as a classical scholar and graceful writer, and for general excellence stood among the first in a class of sixty-five. The Professor of Latin and Belles Lettres, Dr. James W. Alexander, discerned in him those rare literary qualities by which he was always distinguished, and specially commended his essay on the "Causes of Historical Discrepancy," for its maturity of thought and style. He was also proficient in Natural Philosophy as then taught by Professor Joseph Henry, whose magnetic discoveries he was afterwards able to vindicate against rival claimants in Washington. The Princeton of that day, as represented by Professors Henry and Stephen Alexander, with President Welling, has had a moulding influence upon the Smithsonian Institution from its origin.

After his graduation, Mr. Welling at first turned his thoughts to the law as a profession. No doubt his legal studies and tastes, which he never quite abandoned, aided in fitting him for the career of journalist and educator, to which he was destined. For a time he gave private instruction in a distinguished family in Virginia. In 1848 he was married to Miss Genevieve, daughter of General Garnet, of Wakefield. He began his life work in New York City, as principal of the Collegiate Institute and writer on current topics in the higher class of journals. The beauty, correctness, vigor and variety of these productions of his facile pen soon attracted general notice, and in 1850 he was secured by Messrs. Gales and Seaton as the literary editor of the *National Intelligencer*, at Washington. This journal was then a power throughout the country, with an influence such as no local or metropolitan press can now exert. Its editorials, emanating from the seat of government, as carefully written articles on national issues, became almost authoritative with an intelligent class of readers. It was said that a copy of the *National Intelligencer* would indicate the respectability of any one found reading it. For such a post he was specially qualified by his judicial temperament, his facility in writing, his accurate scholarship, his well-stored memory, and his direct acquaintance with public men and measures. As an old line Whig, he made the policy of the paper conservative, constitutional and loyal; at first, supporting the Bell and Everett ticket against the two sectional parties which were dividing the nation;

and then, consistently voicing the Union sentiment of the administration during the war. He enjoyed the full confidence of President Lincoln, who is known to have sought his counsel and had the aid of his editorial pen in commending some important measures to the people. It was at this critical period he advocated the President's proposition of emancipation, with compensation to loyal owners, the abolition of slavery in the District of Columbia, and its abolition throughout the Union by constitutional amendment; but he questioned the validity of the emancipation proclamation and strenuously opposed the constitutionality of military commissions for the trial of citizens in loyal States—a practice which was subsequently condemned by the Supreme Court. This was not the only instance in which his political opinions were vindicated. The discussions of the *Intelligencer* at this time often took the form of elaborate papers on questions of international as well as constitutional law, such as the Monroe Doctrine, the seizure of Mason and Slidell, and exercised an acknowledged influence upon public opinion. Some of them have been republished and are still cited in works of history and jurisprudence. They formed part of his equipment for a "Civil History of the Civil War," which he projected as a needed complement to the Military History which hitherto has engrossed the attention of our historical writers.

On the natural decline of the *Intelligencer*, he withdrew from journalism, and after spending two years partly in European travel and partly in his office of Clerk of the Court of Claims, he then entered the academic career to which the rest of his life was to be devoted. This was in accordance with his expressed opinion that periods of civil commotion are usually followed by revivals of intellectual energy, "when arms must yield to the gown, and when the statesman and the scholar are called to untie with dexterous hand those Gordian knots which the sword left uncut." In 1867 he was chosen President of St. John's College, at Annapolis, Md., and in less than two years the number of students advanced from ninety to two hundred and fifty. He received the honorary degree of LL.D. from Columbia College, Washington. At the same time the voice of his Alma Mater called him to the Chair of Belles Lettres at Princeton, with the prospect of a congenial field of study and influence. His public introductory lecture at the Commencement, on "The Sources of Literary Inspiration," may be said to have heralded that enthusiasm for English Letters by which the college has since been so distinguished.

The high esteem of his former colleagues has been fittingly expressed by Professor William A. Packard, in the following tribute:—

I have very warmly cherished recollections of Dr. Welling. We lived side by side during the time of his residence in Princeton, and I very soon began to know the charm and value of a near personal friendship with one possessed of a most sincere and genial nature, and of eminent and varied qualifications for his work and influence in the Professorship which he so ably filled.

His thorough literary training and accomplishments for his special work, and the large experience of his previous life in Washington, in close contact with great public questions and eminent public men, at once raised his department of instruction to a very high degree of prestige and genuine interest. His lectures and personal intercourse with students were peculiarly fitted to quicken and train their taste in the best English Literature, and to broaden the horizon of their interest by the subjects for thought and study which he set before them. His fidelity also in the daily and detailed work of the class-room, and in the discharge of all the minor obligations of an active member of a College Faculty, was unfailing, and illustrated in a marked way the genuine conscientiousness of Dr. Welling's character.

When he left us for the higher positions which he has since filled with such eminent usefulness

and success, we deeply felt our loss, but have, throughout the years since, heartily appreciated his wider influence in the service of higher education, and his always ready sympathy in the prosperity of his Alma Mater and the experiences of his former colleagues. His death has brought to us a deep sense of personal bereavement.

After a year at Princeton he was recalled to Washington to take the presidency of the institution now known as the Columbian University. Here his administrative powers soon found full scope and activity. He believed it possible to make the Capital, in a sense, the intellectual as well as political metropolis of the country. Its libraries and museums, its Smithsonian Institution, its concourse of scientific men in the service of the government, its great legislature and court illustrating the origin and practice of law, all seemed to him available as the proper environment and educational plant of a national university. He was so far successful that he obtained from Congress a new charter with full university powers, and secured the erection of an academic building in the heart of the city, an enlarged corps of professors, the establishment of professional schools of Law, Medicine and Science, and the foundation of a free endowment. In the School of Law he became especially interested, securing not only a large attendance of government clerks as students, but courses of instruction by distinguished jurists in Washington. At one time, his friend, Gov. Wm. Beach Lawrence, of Rhode Island, by his invitation delivered some university lectures on international questions in our history, which were attended by members of the diplomatic corps, cabinet officers and senators. His crowning effort in this direction was his project, already approved by the ablest publicists, for a School of Comparative Jurisprudence, in which "the law of the civilized world should be taught as a history and as a philosophy, from the first rude germs of the clan stage of human government up to the highest evolutions of that international law which to day sits supreme above all polities and all conventions of men."

During this period he received several invitations to the presidency of other leading colleges, besides offers of lucrative editorships in New York, but his friendship with Mr. Corcoran, the chief benefactor of the Columbian University, held him loyally at his post. He resigned it in June last, with the hope of devoting himself to the favorite studies and projected works which would have made a congenial pastime for the evening of his life.

Outside of his academic labors, his services were sought in behalf of many other public interests. As President of the Corcoran School of Art, in which he took a lively concern, he visited, in 1877, the principal galleries and studios of Europe, and procured some valuable paintings. In 1884 he was appointed a Regent of the Smithsonian Institution, and soon afterwards elected Chairman of its Executive Committee. He was also at different times President of the Philosophical Society, of the Anthropological Society, of the Copy-Right League, of the Cosmos Club, and various charitable associations. His ready pen was at the command of every good cause, literary, artistic, humane or religious.

The life and services of such a man naturally suggest his personality. It is little to say that so practiced a teacher was also an industrious student and an accomplished scholar. He had the skill of a linguist, as well as the taste of a writer, in his use of words, which was copious, elegant and forceful. He touched nothing that he did not adorn. His familiarity with the text of classical and English authors caused apt quotations to flow easily from his pen and to enrich his discourse. Yet he was no mere omnivorous reader. He discriminated and digested the material of his reading, as was shown by the

notes and elippings inserted in his books for future referenee. The Librarian of Congress, Mr. Spofford, who knew him more than twenty-five years, observes: "His frequent visits to the library were always with a definite purpose. His investigations were marked by a habit of thorough research eharacteristic of the careful seholar. He had an instinctive habit of weighing evidenee, and the true eritieal spirit in dealing with authorities. He had a marked fitness for historieal investigation, and might have beeome, had his assoeiations permitted, one of our best writers of history. His style of eomposition was uniformly that of a man of refined taste, grave and elevated when treating of weighty themes; light and free when dealing with the weapons of ridicule or satire. Both in speeeh and in writing he was a purist, though without pedantry, and whoever might sueeumb to the ever-increasing popular slang which eorrupts our noble English speeeh, one was always sure of finding Dr. Welling adhering to elassie models of style. He spoke and wrote against the attempts of eertain 'reformers' to destroy our orthography by the phonetic system of spelling the language."

It was not strange that he liked Washington, with its opportunities for keeping in toueh with the higher interests of eivilization, its ever-changing game of politics, its varied types of eulture, its personages gathered from every part of the land and of the world, its eompanionship of scholars and statesmen like Henry, Chase, Sumner, Blaine, Bayard, Wharton, Baneroft. In sueh eireles his fine eonversational powers, his wealth of personal, literary and historieal allusion, his sallies of humor, and his gentleness, made him always welcome. The Columbian Historical Soeicty, in their memorial tribute, dwell upon the worth of these engaging qualities: "No man ever ate less idle bread. His social duties were important accessories to his publie employments; and few men discharged them so thoroughly and successfully as he. He had hosts of aequaintances and 'troops of friends,' whom he seeured by willingness to serve them, and by a politeness and consideration that amounted to a real virtue."

None of his friendships were quite the same as one or two born of the enthusiasm of his eollege days. For these I gratefully let another speak:

"Fifty-one years ago," says Justiee Hagner, "I made his aequaintanee; at that time our friendship was formed and it eontinued without interruption to the time of his death. 'He was my friend, faithful and just to me.' I am glad to believe he would have said the same of me.

"I never knew one in whose charaeter and demeanor time made less ehange. The rather serious eollege youth, singularly diligent and studious, but eheerful and light-hearted, simply ripened into the indefatigable student and aetive man of business; but he still retained his elastieity of disposition and his youthful feelings and manners. Full of aetive sympathy with whatever surrounded him; alert in his movements, as in his mental activities; his eapacity for the enjoyment of friendship appeared to increase with his years.

"The wounds from the loss of friends are of those that heal slowly. But it is a satisfaetion to me to recall that on a visit reeeived from him just before he left Washington for the last time, his eheerfulness and eharm of manner and eonversation were as marked as ever; and to reeall 'the toueh of a vanished hand' that gave no distressing presage it was to be the last."

President Welling was married on the 27th of June, 1882, to Miss Clementine L., daughter of Senator Dixon, of Conneeticut; and since then passed his summers

at Hartford, where he died in the early morning of September the 4th, 1894. As by a sudden translation, he was spared the pain of an earthly parting from those that he loved. Throughout life he had been a firm and devout believer in the Christian religion, and never wrote a line inconsistent with such a faith.

Distinguished associates and friends attended him to his burial. Memorial services have since been held in Washington, with appropriate addresses, and learned societies have recorded his varied services. The following list of his publications, though far from complete, may afford some glimpses of his literary activity in recent years:

1871. Fundamental Elements of Intellectual Education. Inaugural Address as President of the Columbian College.
1874. The Mecklenburg Declaration of American Independence. North American Review.
Lincoln's Emancipation Proclamation. North American Review.
1878. Life and Character of Joseph Henry. Bulletin of the Philosophical Society of Washington.
1888. The Law of Malthus. American Anthropologist.
Anomalies of Sound Signals. Bulletin of Phil. Society.
1889–94. Reports as President of the Columbian University.
1889. The Atomic Philosophy, Physical and Metaphysical. Presidential Address to Phil. Society, in Bulletin.
1890. Problems in Higher Education. Proceedings of College Association of Middle States.
1891. Slavery in the Territories. Annual Report of Am. Hist. Society.
1892. The Law of Torture. Presidential Address to Anthropological Society.
State Rights and Public Lands. Annual Report of Am. Hist. Society.
1893. The Columbian University in Relation to Washington as the Seat of a National University.
The Last Town Election in Pompeii. Presidential Address to Anthropological Society.
English in the Colleges and Preparatory Schools. Proceedings of the College Association.
The Behring Sea Arbitration. Columbian Univ. Studies.
Pelagic Sealing Juridically Considered. Columbian Univ. Studies.
1894. The Science of Universal History in its Relations to Physical Sciences.
1892. Connecticut Federalism, or Aristocratic Politics in a Social Democracy. Lecture before New York Historical Society.

Dr. Welling contributed many papers of permanent interest to the North American Review, the Nation, the Magazine of American History, and innumerable articles of literary merit to the great daily journals. He is known to have made translations of important French and German works, and it is hoped that he left valuable historical manuscripts which may yet be published.

CHARLES W. SHIELDS.

ABSTRACTS OF PAPERS PUBLISHED.

THE DATIVE IN GENERAL.

By L. B. SEMPLE.

It is not to be supposed that case endings are combinations of vowels and consonants, arbitrarily chosen to express this or that relation. They were originally words which, occupying subordinate positions in stress group, have been worn off to mere appendages of words having the natural stress. But inasmuch as the Indo-European languages had passed out of the monosyllabic stage long before the dates of the oldest literary monument, efforts to trace our inflections to their sources have not in general been successful. Baffled in their attempts to discover the relations of the endings, philologians endeavored to arrive at their fundamental meanings through the medium of comparative grammar; and in this way conclusions have been reached which are fairly satisfactory.

"The genitive seems to be by origin an adnominal or adjective case. The verbal constructions of the genitive appear to be secondary only. There is no difficulty about the satisfactory explanation of them as such. The formation of this case, then, falls into the general department of the derivation from noun-stems of secondary stems signifying 'relating to or concerned with' what is expressed by the primitive stem. Again, in the second place, certain other of the cases appear clearly to have had an office of indicating local relations. These cases are three. The ablative indicates the relation of removal, or is the *from*-case. The instrumental indicates the relation of concomitance or adjacency; it is the *with*- or *by*-case. The locative indicates the relation of place where; it is the *at*- or *in*-case. These views are so widely held that they may be said to have the general assent of linguistic scholars." (Whitney, Trans. of Am. Phil. Assoc., Vol. XIII, 89).

There is not the same unanimity, however, with regard to the fundamental meaning of the dative. Delbrück, Kuhn's Zeitschrift, XVIII, 82, says: "Der Grundbedeutung des vedischen Dativs ist die *Neigung nach etwas hin*. . . . In den Dativ tritt dasjenige Ding nach dem hin etwas anderes sich neigt oder bewegt. Wir sprechen zunächst von *räumlicher* oder doch *räumlich gedachter* Bewegung." Delbrück would thus assign the dative to the category of local cases, giving it the force of a *to*-case. But in his next work, Syntactische Forschungen, referred to by Whitney, p. 92, he rejects this view, and asserts that the dative is a purely grammatical case. Again in Brugmann's Grundriss, Vol. III, 184, he expresses himself as follows: "Nach Gaedicke (Der Accusativ im Veda) trat in den Dativ derjenige Substantivbegriff, dem des Verbalbegriff galt oder nach dem er sich hinneigte. In dem Ausdruck *gelten* spiegelt sich die geläufige grammatische Tradition, der auch das indische *sampradāna* entspricht, in dem Ausdruck *hinneigen* eine lokalistische Anschauung, der ich früher huldigte. Ich habe KZ., 18, 100ff. ausgeführt, dass die Grundbedeutung des Dativs sei: die körperliche Neigung nach etwas hin, und habe deutlich zu machen gesucht, wie dieser Kasus oder eigentlich die in ihm enthaltene Präposition wohl in der Urzeit entstanden sein möchte. Da ich jetzt ein entschiedenes Misstrauen gegen glottogonische Hypothesen hege, so fällt diese Darlegung jetzt für mich nicht mehr in's Gewicht. Auch von einer allgemeinen Vorliebe für lokalistisch gefärbte Erklärungen, die ich damals wohl hatte, weiss ich mich jetzt frei und ich sehe mich daher jetzt bei der Entscheidung zwischen den beiden

Möglichkeiten der Auffassung lediglich auf eine Befragung der Ueberlieferung angewiesen. Diese aber scheint mir für die geistige Auffassung zu entscheiden. Es spricht für sie der Umstand, dass in den Dativ ganz überwiegend Personen treten, was gewiss nicht der Fall sein würde, wenn der Dativ ein Zielkasus wäre. Insbesondere erscheint bei 'gehen' und ähnlichen Verben im Veda nicht irgend ein ruhender Theil des Raumes, sondern eine Person im Dativ, die nicht eigentlich als Ziel gedacht sein wird. Dabei wird nicht geleugnet, dass im spätern Sanskrit und sonst in indischen Dialekten wirkliche Zieldative vorkommen."

This time, as will be seen, Delbrück, rejecting speculation, arrives at the conclusion that the dative is a grammatical case, by an appeal to its use in the oldest literary monuments and shifts upon Gaedicke the responsibility of the use of the expression "which the predicate concerns," to which Whitney had forcibly objected. But when we remember that all linguistic development has been from particulars to generals, that in the verb "give" for instance, the idea in the mind of the first speakers must have been that of motion from one place to another before the action could be completed, it seems to me that the remarks of Whitney, p. 92, upon grammatical forms in general are particularly appropriate. "To explain the case (dative) as *per se* the indicator of a grammatical relation, namely, that of something affected by the predication, appears to me like a virtual confession of ignorance made under cover of a claim of positive knowledge. There is no such thing in language as an originally grammatical case or form of any kind, this can only be the outcome of a series of adapting changes passed upon something that had once a sensible and definable value. One might as well explain the subjunctive as a purely grammatical mode indicating contingency of action; or *of* as the sign of the grammatically adjective relation of one noun to the other; or the passive as a voice created to signify recipience of action."

These statements will appeal forcibly to most students. They leave us no right to assume that the dative was originally a grammatical case. Does an examination of the uses of the dative in the older languages prove more satisfactory? According to Delbrück such an examination decides the question in favor of the "geistige Auffassung." Why? "Because the dative in the Veda for the most part denotes persons." Which fact rightly interpreted in connection with the other means of denoting motion *to*, means simply, that at the time of our oldest literary monuments, prepositions had limited somewhat the use of the simple dative as the case of end of motion. In fact comparative grammar is not of great assistance to us, a confession which Whitney makes (p. 96) with regard to the accusative, but its application is not, I suppose, confined to that case. "It is a matter of course that no mere study and classification of the uses of the accusative [dative] will ever bring us to a peremptory theory of their origin and mutual connections. The shifts and transfers, the extensions and restrictions, gradually brought about by usage, are too manifold and baffling for that."

Comparative grammar has indeed rendered an uncertain sound, as Delbrück's guarded expression clearly shows. Whatever his opinion of the matter may be, the fact still remains that the dative is used to denote end of motion in all Indo-European languages, and that not only with verbs which *express* motion, but with the larger class of those whose action necessarily *implies* motion.

If, then, we wish to arrive at a conclusion, we must have recourse to theory, and we must approach the subject prejudiced in favor of the local view. (Whitney, p. 97).

"It may be laid down as a universal truth that all designation of the relation of objects, as well as of objects themselves and their activities, begins with what is most physical, most directly apprehensible by the senses. Among the relations of objects those of place are obviously the most physical and sensible, and our languages are filled with results of the transfers of designation from local to more ideal relations." (Whitney, p. 91.)

We may further agree with Whitney regarding the antecedent improbability that in any scheme of designation of local relations, the simple and fundamental *to*-relation would be left out. But should we look to the accusative, as Whitney maintains, for the designation of this *to*-relation? I think not. Surely the statement, "the direct object designates the person or thing *to* or *unto* or *upon* which, the action expressed by the verb directs or expends itself," (Whitney, p. 96), can be but partially affirmed. The direct object *does* designate the person or thing *upon* which the action of the verb expends itself; but to assign to it the functions of a *to*- and an *unto*-relation is to make a statement unwarranted by the facts. In no case in which an accusative form denoting "the place to which" follows a verb, can the noun be said to have any special part in the action of the verb, such part as we are wonted to expect the direct object to have. Compare *domum* and *mundum* in the sentence *Scipio domum reductus est*, and *Deus mundum aedificavit.* There is a great difference between the notions expressed by these accusatives. *Mundum* designates the thing upon which the action of the verb directs or expends itself; while this is not true of *domum* simply because *domum* does not participate in the action of the verb at all. That *domum* is used with a passive verb shows, moreover, that we have to do with a phenomenon entirely different from the direct object.

If, now, the use of the accusative without a preposition as a goal of motion is an original one, we should find many examples in Indo-European literatures. As a matter of fact these examples are exceptional and by no means such as to determine the character of the case. In Sanscrit it is found with a few verbs only; in Homer its use is equally restricted; "die griechische Prosa scheint sich dieses Accusativs durchaus entschlegen zu haben;" in Latin it is used "neben Verben der Bewegung in der Sprache des Volkes und bei Dichtern bei mehreren Ortsbegriffen, in der klassischen Sprache nur noch bei Namen von Städten und Inseln, und in *domum, domos, rus;*" "aus dem Germanischen lässt sich ausser *heim* in *heimgehen*, das aber nicht mehr als Accusativ empfunden wird, einiges aus dem Altnordischen und Angelsachischen beibringen; im Litauischen ist dieser Accusativ nicht, im Slavischen kaum nachgewiesen," (Brugmann, Vol. III, 364). Not a very encouraging outlook this, for the accusative as the original case of the *to*-relation.

It is not my object to determine the fundamental meaning of the accusative case. Without going into a discussion of the question, I shall simply say that I regard it as the case of the *upon*-relation—a notion which is at least as primitive as that of motive *to* a place. The accusative as a goal of motion, therefore, represents a "transfer." It is noteworthy that in Latin motion *to* or *toward* is regularly expressed by *ad* or *in* with the accusative case. Now when prepositions came into use, there must have been a feeling on the part of speakers—and the feeling must have grown rapidly—that the preposition expressed the relation, whatever that might be; consequently there would be a tendency to attach to the preposition the less highly inflected part of the noun. It is true in general, I think, that with regard to form, the accusative stands nearer to the

nominative, or stem, than any other oblique case; in a large class of nouns—neuters—the two cases are identical. In modern languages we learn as a primary rule that the accusative is the proper case to use with prepositions. It is not too much to say that the introduction of prepositions tends to simplify case-forms, or, in other words, the *accusative with preposition* absorbs the functions of other cases. But the well known rule of Latin grammar tells us that "names of towns are used without the preposition, and that *domus* and *rus* are used like names of towns." It would be nearer the truth to say that *domus* omits the prepositions, and *rus* and names of towns are used like *domus*. For undoubtedly the introduction of prepositions to express relations, brought the accusative after them, and in the case of *domus*, a word which comes natural to every tongue, and is used more frequently than any other as the end of motion, familiarity bred contempt for the preposition. Thus the idiom crystallized in the case of *domus*, was transferred to *rus* and similar nouns.

Having thus disposed of the simple accusative and the accusative with prepositions as the original method of expressing the *to*-relation, we must find a substitute for them. Notwithstanding all that has been written against the view, I think we must find it, if we find it at all, in the dative. Any attempt to prove that the dative is the original case of the *to*-relation, must be futile; but the following considerations seem to me to speak loudly in its favor:

1st. No other case-form has the slightest claim to be considered such. The only rival of the dative in this domain is the accusative, and that is the *upon*-case—an expression which is by no means synonymous with the *to*- and *unto*-case.

2nd. The frequent use of the dative in all Indo-European languages with verbs like *go*, *bring*, &c., where the dative expresses either end of motion or nothing. This can hardly be accidental. While it cannot be expected that any case-system will remain perfect, still it must be acknowledged that the development of forms has been in the direction of simplicity. But the transfer of a *to*-relation from the accusative to the dative would be diametrically opposed to such development. The dative in Latin poetry is of the nature of confirmatory evidence, as poetry is notably partial to primitive forms of all kinds.

3rd. The use of the dative with verbs implying motion *to* or *toward*. This covers the indirect object, which has been regarded as the special function of the dative. The difference between *Onsend Hîgelâce beadu-scrûda betst* and *Gif Hîgelâce beadu-scrûda betst* (so far as the relation of noun to verb is concerned), consists in this: the verb in the first sentence denotes motion simply, while the verb in the second connotes it. In each case *Hîgelâce* is the end of motion. The fact that the dative with verbs of these classes usually represents a person—a fact to which Delbrück attaches great importance—is of no weight, inasmuch as, logically considered, the end of motion may as well be a person or thing as a place.

4th. The characteristic of the dative seems to point directly to motion *to* or *toward* as the original meaning of the case. According to Brugmann, the characteristic of the dative singular is *ai* or simply *i*. What is this *i?* I am inclined to see a relation between it and the pronoun *i* or *ei*. To be sure this *i* has already been employed by Schmidt, Kuhn's Zeit., XXV., 6, as sign of the plural through the form *toi*. Schmidt would thus resolve *toi* into *to*+*i*=this and that=they, who, the, &c. This explanation is eminently satisfactory for *toi*, but this *i* could have been attached to other words as plural sign, only after it had entirely lost its individuality. No one

would seriously maintain that our primitive word-makers attempted to render a noun plural—horse for instance—by attaching to it the demonstrative pronoun *that*. Moreover there is another and more common plural sign, *s*. Attached to a noun the pronoun *i* would have a meaning, and just the one that our dative case in my opinion requires. It may be noted that the *i* appears in the plural as well as in the singular dative.

Dative in Bēowulf. With the exception of a few remains, chiefly pronominal, of the instrumental, the Old English inflectional system contains four case-forms; namely, nominative, genitive, dative, and accusative. Comparing this scheme with that of the Sanscrit, we note a total loss of two cases, viz., the locative and the ablative, and an almost complete loss of the instrumental. Of the relations expressed by these lost forms, some are denoted by means of prepositions, others have become functions of the remaining oblique cases, dative and genitive. The dative has absorbed the greater number, although the line of division is not always closely drawn. (Compare the ablative relation of separation, Bēowulf, 969, *ganges getivæman.*)

Since then, the dative is a syncretical case, it has been deemed best to classify the examples under these four heads: the pure dative, the locative dative, the instrumental dative, and the ablative dative. In this abstract only the principles upon which this division is based can be indicated.

The Pure Dative. The Pure Dative, expressing motion *to* or *toward*, is used (a) with the verbs beran, bringan, cuman, hwcorfan, sendan, and gespringan; (b) with verbs whose action implies motion—fōn aetfēolan, krīnan, forniman, forgrindan, forgrīpan, and many verbs of giving and helping. At one remove from class (b) stand verbs of saying and the like. Next comes the dative of interest, used in connection with all verbs, transitive and intransitive, to denote the person toward whom the action is directed—in whose interest the action is performed. The substantive verb with its complementary noun or adjective is frequently accompanied with such a dative. With the verb "to be" used absolutely, and with nouns like hand, heart, &c., the dative takes upon itself the idea of possession. In such collocations as *wilcuman*, *Deniga lēodum* (l. 389), and *him wilcuman* (l. 393), the dative seems to depend upon the second component of the leading word.

An interesting construction is that of the double dative—to which and for which. The latter is accompanied by the preposition to. This construction recalls the Latin idiom. It is especially common with the verb *weordan*, and survives partially in the German phrase *werden zu* (cf. zum Geläehter werden).

The dative with adjectives is a common construction. It may be noted that the construction with forgripan mentioned above, is found also with the adjective of the same root aetgraepe (l. 1270).

A pronominal dative denoting the person of the subject, accompanies the verb gewītan. This is no doubt a dative of interest—a notion which is more prominent in the parallel construction with ondraedan.

The preposition which accompanies the pure dative is *to*. It is used to express end of motion and purpose. In four cases it is clearly redundant; ll. 270, 360, 1172, 1579.

The Locative Dative. The dative, absolutely in a few cases, but usually in connection with a preposition, may denote *place where* and *time when*—ll. 163, 233, 441, 1008, etc.; 88, 275, 741, etc.

The prepositions accompanying this dative are *on* and its doublet *in*. *On* in the sense of *upon* is found in ll. 1936, 2456, 2466, 2906, 3127.

The locative is also found with *aet, aefter, ofer, under, betwēonum, to.* For examples of the last see ll. 489, 1243, 1837, 1991.

Instrumental Dative. The idea underlying the use of the dative as instrumental, is that of association; ll. 510, 538, 923, 1012.

In ll. 1023, 3140, 3147, accompaniment and means are expressed, and these examples may serve to show transition from association to means, which is the idea most frequently expressed by this dative.

The dative of price is found in ll. 2497, 2844, 2970, 3015.

Degree of difference is expressed in ll. 1487, 2688 and elsewhere; in ll. 625, and 1790, examples of the dative of specification are to be found.

The verb *wealdan* is regularly followed by the instrumental, ll. 30, 465, 1058, etc.

The prepositions found with the instrumental are such as involve the idea of association—*mid, neah, samod, getenge, be, to-gēanes,* and *wit.*

The Ablative Dative. The fundamental idea of the dative as representative of the ablative, is that of separation. It is found, therefore, with verbs signifying removal and the like; ll. 106, 143, etc. Source is expressed in ll. 12, 56, 59, 1357, by the simple dative; by the dative with *aet* in ll. 630, 931, 1378, 2150, 2357, 2430, 2861. It is worthy of notice that this same notion is expressed by *to* with the verbs *wēnan* and *ahsian*—ll. 158, 525, 602, 1208, 1397, 2923.

The usual prepositions accompanying the ablative dative are *from* and *of.*

[Abstract of thesis presented for the degree of Doctor of Philosophy, June, 1894.]

THE EDUCATION OF WILLIAM LANGLAND.

By E. M HOPKINS.

Few authors of such prominence in literary history are so little known as regards the details of the outer life, as the author of "Piers the Plowman." What he thought is fully written; what he was, is to be read only between the lines: and while to read between the lines of such work as his is interesting, the results thus arrived at are likely to be open to question for some time to come.

One query touching his outer life is as to the probable nature and extent of his scholastic training, whether or not received at one of the great universities, and if so, under what circumstances. Two of the most eminent students of the life and work of Langland, Professor ten Brink and M. Jusserand, agree in supposing that he received a university training. Professor ten Brink[1] believes it "most probable," and thinks it also probable that his training was received at Oxford. M. Jusserand, in his recently published work,[2] is much more specific. He says,[3] "Certain sciences of which he had a tincture were taught only at the universities, and he could only have acquired a knowledge of them at Oxford or Cambridge." He shows that clerks in priory schools often received licenses to attend lectures at the universities and elsewhere; and he shows also that the list of Langland's attainments includes "theology, logic, grammar, prosody, law, natural history," and astronomy. He knows something of French, something of the classics, and a great deal of mediæval Latin.

One may well hesitate before doubting a conclusion advanced by so distinguished a student; but it happened that in a thesis[4] published just as M. Jusserand's work appeared, I had advanced an opposite opinion. In reviewing my work in search of error, while I find that the facts adduced by M. Jusserand are indisputable,

[1] ten Brink, Early English Literature, p. 352.

[2] Piers Plowman. A Contribution to the History of English Mysticism. New York, Putnam's, 1894.

[3] Ibid., p. 81 ff.

[4] Character and Opinions of William Langland. Presented to the Faculty of the College of New Jersey for the degree of Ph.D., 1894.

I find that they make his conclusion merely probable; and I still believe that there are other facts that if fully estimated may serve to incline the balance of probability the other way.

An attempt at direct investigation yields little evidence upon either side, beyond the statement that at an early age he was sent to school by his father with the aid of friends, and that he remained there till he learned to interpret Holy Writ in Latin.[5] He dearly loved the life of a scholar, but at an undetermined stage in his education, his friends died; and compelled to shift for himself, the young man chose the life of a cleric because he did not love labor.

The next fact of which we can be reasonably certain is that at about the year 1362, when Langland was about thirty years old, he produced the earliest version of his poem. As this stands so near to his early life, as compared with the next version, written seventeen years later, it ought, at least by implication, to show something of how those thirty years had been passed. But it does not show much. It is full of indignation against wrong, and indignation that is more vigorous than that expressed later, though not more sincere. It also breathes a spirit of the country; its scenes are oftener those of the country than of the city, though it shows that the author had already become well acquainted with London. It displays a most minute knowledge of country life and of wayfaring life; the duties of the humbler classes of society, their tools and methods of using them, and even their food.

Such knowledge was, of course, not acquired in the university; but by this time Langland had learned Latin, and if he had had friends, time and an opportunity, why might he not have learned it at the university? To examine his allusions to portions of the country outside of London might give some light, but it proves not to do so. Almost the only specific allusion to any place outside of London, as one with which the author is acquainted, is that to the Malvern Hills. Taking all the texts into account, the number of allusions to places outside of London is very small; and if any use can be made of them at all in this connection, they indicate a general acquaintance with the country lying between Shropshire and London, and from London northeastward. The lines thus indicated would pass reasonably near Oxford and Cambridge; and while Cambridge may be disregarded, Oxford is left, between the boy Langland and London, easily accessible.

Text A, the earliest version, has more to say of men and less of books than later texts, and does show that much of his early life had been passed in the free and open air of the fields. If he knew books and sciences at this time, he cared less to display that knowledge. But it is next in order to ask what Langland knew, in order to determine if we may, where that knowledge was acquired.

In passing, it may be noted that the list of Langland's attainments given by M. Jusserand is largely taken from a passage in Text A.[6] We may not, however, think that it in any sense indicates what Langland had learned at the university, unless we conclude also that the handicrafts were taught there, and the instruction emphasized with beatings. But it seems to me of more importance to ascertain not only what branches of learning are mentioned by Langland, but how much he knew of each, and how systematic his knowledge was.

Langland simply mentions the "seven arts" that comprised the circle of scientific knowledge of his time. If we take some of these up individually, we find

[5] Text C, VI, 35.

[6] A, XI, 127 ff.

that he makes a feeble use of a single point in grammatical theory and a more spirited one of some fragments of logical formulæ, while some of the several arts, including astronomy and geometry, he considered it evil to know. With the "Secretorum Secretorum," the source of popular knowledge on matters scientific and philosophical, he was apparently not acquainted; and if we examine Gower's labored summary of the same work,[7] we shall soon conclude that Langland knew little and cared less about the system unfolded in it. He does not even define the four elements correctly.[8]

His discussion of natural history and of medical science is based on the Bestiaries, on personal observation, on popular beliefs, and indirectly on Aristotle. The scholar's authorities whom Chaucer quotes do not exist for Langland; nor has he the scholar's habit of quoting his authorities. The sum of his medical and scientific knowledge comes to little; it is composed chiefly of old wives' fables and old wives' remedies.

In attempting to make use of his knowledge of grammar to illustrate the distinction between Reward and Bribery, he succeeds in making his meaning clear, not because of his illustration, but in spite of it.[9] He shows his interest in the subject in both the B-text[10] and the C-text, but had either taken it up very recently or else had had time to forget much that he may once have known of its theory.

His knowledge of logic, which M. Jusserand shows to be involved in his use of certain formulæ of disputation, or rather certain portions of those formulæ,[11] seems to be exhibited in no other way. But with law and legal forms he shows a greater familiarity, and in Text A[12] speaks of copying for merchants what were presumably legal papers. Moreover, he refers often to Westminster and describes its practices. Possibly his logical and legal formulæ were learned at the same place, and that place the court of law, near which, if anywhere, a copyist might find employment.

Formal philosophy Langland had from a single passage of a single author, quoted and requoted until it was evidently regarded as common property.[13] He has his own philosophy and his own political science, but these assuredly not those of the books of his time, and as little systematic as anything yet noticed.

He knows the measures in music, as was necessary if he was to sing for the souls of the departed. He knows of course, best of all, the Vulgate, and the doctrines and practices of the church of which he was a member. He could mistranslate a Latin passage not from the Vulgate. He knows some French, and seems to have a general acquaintance with the contents of some French books.

In this review, those arts stand out most prominently of which Langland made use in obtaining a livelihood, but there is nothing to show where he had learned them. It may be asked finally what books Langland knew, in order to determine where he was likely to see them.

The list is given very fully by Professor Skeat.[14] I have endeavored to ascertain the number of quotations from all the sources mentioned,[15] and I find that of about 475 almost nine-tenths are from the Vulgate, from the services of the church, from the church fathers, and from Latin hymns. Of the rest, there are five from the "Legenda Aurea" of Jacobus de Voragine, nine from the "Disticha de Moribus ad Filium" of Dionysius Cato, three from the "Historia Scholastica" of Peter

[7] Gower's Confessio Amantis, Part VII.
[8] Thesis, p. 240.
[9] C, IV, 335 ff.
[10] B, XV, 365.
[11] Jusserand, Piers Plowman, p. 82.
[12] A, VIII, 42.
[13] Thesis, p. 272.
[14] Piers Plowman, E. E. T. S. edition, Vol. IV, § 1, p. 512.
[15] Thesis, p. 285.

Comestor, two from the "Compendium" of Peter Cantor, and one each from Bœthius and Juvenal. Then there are three or four in French which Professor Skeat has been unable to trace, and suspects to be of Langland's own composition. There are also many general allusions to these and other literary sources.

Langland's few direct references to authors are often incorrect, or he gives the sense of the authors quoted rather than their exact words. Such errors are fewer in the references to the Vulgate, but occur even there. Many references are clearly second-hand or else purely general. It seems evident, therefore, that while Langland had a most retentive memory, he had access to only a few volumes, in which quotations from all sources abounded after the fashion of the time, and those volumes such as were most likely to be found in "priory orminster" or in monastic schools. And his general knowledge is so very general that, while it might indeed have been gathered in his youth, at a time when all studies were of interest to him, it might as easily have been gathered through intercourse with reading men.

In summary, then, it seems that a positive conclusion with reference to the university question cannot be arrived at from any evidence yet presented. Langland's travels probably led him near the University of Oxford, but there are no local allusions to show actual acquaintance with it. M. Jusserand has shown that students at monastic schools frequently did attend courses of lectures at the great universities, hence it was possible for Langland to do so. He knew something of many subjects that were taught at the universities, and taught there only, so far as systematic instruction was concerned. But examination shows that what he knew upon such of these subjects as were most likely to be learned in this way was so little as to be practically nothing, and was not systematic, at a time when instruction was nothing if not systematic, according to the ideas of the scholastics. The books that he knew were such as would be found in monastic schools as well as in the universities, while those that he merely mentions are such as others might mention to him. One can, therefore, from these considerations neither affirm nor deny that Langland may have attended a few lectures at a university. If any, their number must have been small; for the scholastic methods were systematic and authorities were cited at every turn, as may easily be verified from the work of Gower or Chaucer—more easily still from prose writers of the period. And Langland, who dearly loved learning, to whom school was, as he says, a heaven upon earth, whose memory was retentive, should it seems have retained something more of what he had heard than a few disconnected and sometimes unintelligible scraps. Had he not more probably gathered these scraps from contact with men who had been where he had not been?

Finally, what is to me the strongest argument still remains, and I simply restate it as at first advanced.[16] This is that there is nowhere in either text the slightest reference to any university or the slightest reflection of university life. The poem does reflect, with this exception, all the life that Langland had presumably lived; not a life of great variety, but as varied as that of most men There is the country of his boyhood, and the crowded streets of London; the law court, and the church. He mentions the school of his early days and its influence upon him. All except the school is described or reflected in detail; the details sometimes including the names of places. Whatever has touched him closely, has deeply interested him, is thus

[16] Thesis, p. 287.

reflected. I cannot escape the conclusion that his school life was comparatively brief, and that even a brief experience of university life would have so impressed him that we should surely find evidence of it. But the only evidence is that pride in a little learning that a man almost wholly self-taught might be supposed to feel, and that general and slight knowledge of many subjects that a diligent student much in company with students might easily acquire.

(Abstract of a thesis presented for the degree of Doctor of Philosophy, June, 1894.)

THE KANTIAN EPISTEMOLOGY AND THEISM.

By C. W. HODGE.

Reality is the presupposition of all philosophy, and the determination of its nature and the relations of its parts to each other is the problem of philosophy. With this problem is that of knowledge most closely connected, for as reality becomes a part of our conscious experience we can define knowledge as the idea of reality.

Kant's problem is that of knowledge. He seeks to show the impossibility of all dogmatic proofs of the possibility of knowledge, and also to vindicate knowledge in the sphere of science against the skepticism of Hume.

This dissertation is an attempt to examine his Epistemology and Theistic discussion.

First is a brief discussion of the rational movement of Descartes, Spinoza, Leibnitz, and Wolff, and also of the empirical movement through Locke and Hume, showing mechanism to be the prevailing category of both these philosophies. Then Kant's relation to both is shown. He shows that neither from the analysis of concepts, nor from the contact of objects with our sense organs, can the possibility of knowledge be demonstrated. The former method gives only analytic judgments, the latter only *a posteriori* ones. Kant's problem, then, is to inquire how judgments are possible which are at once synthetic and *a priori*. Our dissertation seeks to show that two presuppositions are necessary; the first of which is the great constructive work of Kant, and the latter of which he neglected, and so was led into the negative side of his system. The first presupposition is the activity of mind. This is brought out by Kant, in the "Critique of Pure Reason," in the spheres of perception and scientific cognition; and in the deduction of the categories he shows that everything is, and is object of knowledge only for a unifying self-consciousness.

The second presupposition necessary to knowledge is that reality is rational. It is sought to show that Kant failed to realize this, and that in accepting the mechanical presuppositions of Hume himself he was led to the negative conclusions which contradict the spirit of his own system. It is shown that the spirit of the Critique of Pure Reason is against the acceptation of Hume's mechanical presuppositions, since the truth of this second postulate of knowledge—*i. e.*, the rationality and spirituality of reality—follows from the truth of the first postulate, which it is Kant's own work to expound. The contradictions involved in its denial are shown in an examination of Kant's doctrine of the "Synthetic Unity of Apperception," and that of the subjectivity of the categories where that of causality is taken for discussion. The conclusion is reached, first, that there is a unity of experience; and, secondly, an objectivity of the categories both different from Kant's view, where the unity of experience is external and mechanical, not organic; and the objectivity of the categories is empirical, not metaphysical.

Passing on to the sphere of metaphysics, we have Kant's treatment of the ideas of

Reason in Rational Psychology, Rational Cosmology, and Rational Theology. Kant is criticised in the first place for making them mere logical universals, and in the second place for holding them to be merely subjective. One source of the doctrine of their subjectivity is the fact that he believes them to be merely logical universals, and the other reason is his failure to recognize that the real is rational. Both of these points are discussed.

Taking up now especially the problem of Theism or Rational Theology—*i. e.*, the determination of the nature of Absolute Being and its relation to the Relative—a brief introduction is given showing the importance of this problem in justification of the second postulate of knowledge, and the fact that the doctrines of immanence and transcendence are to be united. The doctrine of immanence alone gives a pantheistic system like Hegelianism, while that of transcendence alone results in Agnosticism. It is by holding transcendence only and the doctrine of the mechanical relation of God to the world that Kant is led to his destructive criticism of the theistic arguments; but it is really Deism, not Theism, which he criticises. He should have admitted the truth of immanence. However, only a self-conscious personal spirit can be both immanent and transcendent. The question is, what grounds have we for applying these categories to the absolute? The grounds are the theistic arguments.

Before examining these it is shown that it is not the God of Theism, rightly understood, which Kant makes the basis of his discussion, and his mechanical idea of God is criticised.

Next come the theistic arguments, which are stated, and Kant's criticism of them examined.

First, the Ontological argument. This has two sides. *A priori* it tells us that if Absolute Being exist, we must predicate infinity of its attributes and identify it with the All-Perfect Being; *a posteriori* this argument expresses the truth that God, through this perfect idea, has spoken in and to the consciousness of humanity, so that His existence and nature can be in part inferred therefrom. Three possible views are stated with reference to this argument: First, that of Anselm, who holds it to be an *a priori* demonstration of existence; second, that of Leibnitz, which does not differ materially from Anselm's; third, the position stated above. Kant overthrows the first two of these positions by showing the difference between analytic and synthetic judgments, and that being is not a real predicate. The third view he leaves untouched.

Second, the Cosmological argument, which is given us by Aristotle. This is the argument for a First Mover conceiving the world under the category of motion, or the argument from the contingent to the necessary. In meeting the Kantian criticism here, the function of this argument is stated as merely giving the existence of Necessary Being without determining its nature; and it is shown that Kant criticises this argument because it does not do the work of the ontological as well as its own. His other criticism of this argument is the denial of a metaphysical use of the causal category, which denial is shown to be the result of an *a priori* assumption that the causal sequence of science is the only kind of causality, and to overlook the fact that this involves something more.

Third, the Teleological argument, which reasons from the order and adaptation observable in Nature to design, and thence to the Intelligence of the Absolute.

Kant has two criticisms of this argument in the "Critique of Pure Reason." First, in this manner we can only infer the existence of an intelligent Architect, not a Creator of the world; and, secondly,

only an intelligence proportional to the effects, which are relative only. As to the first criticism, it is shown that it demands too much of this argument, which only seeks to show that the Absolute is possessed of intelligence; and, moreover, that it could be brought forward only if order were something superimposed on phenomena and not of their very essence. The other objection is granted as not being the function of this argument.

Kant's most subtle objection to the teleological argument is found in the "Critique of Judgment." Before the discussion of this the argument is further discussed and analyzed into three steps: First, the observation of order and adaptation in nature; second, the inference of finality from this; and, third, the inference of intentionality from finality. These points are discussed briefly and the theory of Hartmann touched upon. Kant's discussion in the "Critique of Judgment" is put under these heads for examination. The nerve of his criticism, however, is that finality is merely a subjective principle of the reflective judgment—*i. e.*, it is not a category which renders experience possible—but is reached by trying to find a concept for an empirical law. His doctrine of finality is open to the following objections:

First, his deduction of the principle of finality from a necessity of connecting the spheres of nature and freedom, while true and at the foundation of all spiritual metaphysics, is out of place in this argument, which has to do merely with the sphere of natural phenomena, and is wholly *a posteriori*. Hence, even were reason not ontologic, the objection is irrelevant, as we are not discussing reason's highest category in this place.

Secondly, the doctrine of the subjective nature of this *a posteriori* category is open to criticism. It is conceded that it is not objective in the sense of conditioning experience as the causal category, but it is denied that experience is unable to prove it. It is forced upon us by observation of nature. This point is discussed, but must here be omitted for want of space. Also, it is to be remembered that it is finality, and not intentionality, which is under discussion.

The dissertation is concluded with an examination of the "Metaphysics of Ethics," and the "Critique of Practical Reason," so far as these bear on the theistic problem. It is sought to show that God stands in too external a relation to Ethics in Kant's doctrine; and, further, that if our noumenal self carry with it a moral ideal, God also must be conceived as possessed of moral attributes.

Finally, Kant is criticised as to the grounds for holding that our moral nature alone opens to us the noumenal world. These points also, though fully discussed, must here be omitted.

It is concluded that, though he was held back by the mechanical categories of the eighteenth century, Kant, more than any other, broke their force; and that his work, on the whole, was constructive.

(Abstract of Thesis presented for the degree of Doctor of Philosophy, June, 1894.)

SUMMARY OF ARTICLES IN THE BANKER'S MAGAZINE.

By W. M. DANIELS.

In the January number for 1895 was published an article on the Popular Character of the National Banks. The salient changes in the original constitution of the National Banks are discussed, and the existing system is compared with the system created by the Acts of 1863 and 1864. The three most important changes are the abolition of certain quasi-monopoly features, the decreased importance of circulation as a source of profit, and the shifted territorial center of banking activity. The

monopoly features which have disappeared were the limitation on the aggregate circulation, and the high bond deposit originally required as the basis for the note circulation. The limitation of the aggregate circulation was first fixed at $300,000,000; then raised to $354,000,000, and finally abolished altogether by the Resumption Act of 1875. The minimum bond deposit required was reduced from $30,000 to $12,500 in 1882. The effect of this latter provision was largely to increase the number of national banking concerns in the southwest and west. A statistical table compiled from the annual Reports of the Comptroller of the Currency for the past five years shows the westward trend of banking activity. The decrease in the aggregate note circulation, due to the voluntary retirement of issues, shows the decreased importance of circulation as a source of banking profit.

In the February number of the magazine appeared an article upon the Low Prices of Products. A statistical computation is there made of the staple crops for the past year, and their money yield to the producers. The abnormally low range of prices for two of our exports alone—cotton and wheat—will occasion a loss, as compared with a normal year's output, of something like $150,000,000. The analysis of live stock and provision exports for the same period indicates a large net gain, however, while the loss on the export of breadstuffs is over $60,000,000.

In the March number appeared an article on American Imports and Exports for four years past. The study of the comparative valuations for exports and imports since 1891 must be made with special regard to three conditions which are at present of vital importance: *to wit*, the current commercial stagnation which mirrors itself in a dwindling volume of trade, the tariff changes which irregularly increased and decreased the imports of certain goods, and, lastly, the abnormally great fall in money prices which has taken place within the last two years. The aggregate export valuations for the past four years present a diminishing series of 957, 923, 854 and 807 millions of dollars respectively. The import series runs 828, 876, 776 and 676 millions respectively. The greater relative decrease in imports has been largely made good by the large gold exports which have occasioned recently so much alarm in our own financial circles. In the matter of imports the greatest shrinkage is found in the case of raw textile materials —flax, hemp, jute, etc. Manufactures of iron and steel, and also manufactures of wool, decreased largely. The quantities of tea and coffee imported increased, and the valuation of the latter by almost $10,000,000. In the matter of exports the greatest fall in valuation is to be found in the item of breadstuffs. The export valuations of cotton for 1894 are about the same as for the year preceding, but the quantity exported that year will exceed that of 1893 by a million bales. This gives a good idea of the effect of low prices in affecting aggregate valuations in foreign trade. The volume of our manufactured exports has remained comparatively steady, though it appears that Russian petroleum is giving the American product sharp competition in certain foreign markets.

There has been no great change in the geographical distribution of our foreign trade, although the slight increase in our commerce with South America and Central America has been noticed with gratification disproportionate to the importance of the fact itself. Nearness of geographical position is largely offset by the fact that the natural exports of North and South America are to a large extent crude materials, for which Europe is the best market.

CRUSTACEA DECAPODA AND SCHIZOPODA OF THE GERMAN PLANKTON-EXPEDITION.

By ARNOLD E. ORTMANN.

Exeept a few litoral and abyssal specimens, the main material representing the higher Crustaceans collected by the German Plankton-expedition contains a great number of true inhabitants of the open ocean, called by *Hensen*, the leader of the expedition, "plankton," and differing from those living on the shores and at the bottom of the sea by their swimming and drifting habits. Systematically, this "plankton" belongs to four different groups of higher Crustaceans, to the *Euphausiacea*, the *Mysidacea*, the *Decapoda*, and to various *larval stages*. The Euphausiacea and Mysidacea represent the old systematic group of *Schizopoda*, but since the Danish carcinologist, *Boas*, ten years ago pointed out that important differences exist between these two groups, the group of Schizopoda can not be retained. The larval forms of Crustaceans must be discussed separately, according to their peculiar morphological and biological characters which often differ from those of their parents.

The *Euphausiacea* are very characteristic forms of the "plankton." Most of the species formerly known were described by *G. O. Sars* in his report on the Schizopoda of the "Challenger" expedition. Of the six pelagic genera known, five were collected by the "Plankton" expedition, and also nearly all of the species described up to the present time, besides a few new ones. Of the *Mysidacea*, only the family of *Mysidæ* is represented in the open sea, and only three genera: *Siriella*, *Euchætomera*, *Cæsaromyris* (nov. gen.) are the common forms. With regard to the horizontal and vertical distribution of the pelagic Euphausiacea and Mysidacea, it is proved by the hauls of the "plankton" expedition, that by much the greater number of the species are restricted to the tropical parts both of the Atlantic and Pacific oceans, but a few show nearly a cosmopolitan distribution. Nearly all the species were obtained on or near the surface of the sea, especially within a belt of about 200 fathoms from the surface. This fact agrees very well with the results obtained by Prof. *A. Agassiz* in examining oceanic life.

Among the *Decapoda* the *Sergestidæ* are the most important pelagic family, representatives being distributed in an abundant number of species and specimens throughout all seas. Their horizontal and vertical range agrees wholly with that of the pelagic Euphausiacea and Mysidacea. A very interesting group of Decapoda is formed by five species living on the floating gulf-weed (sargassum), in the middle of the northern sub-tropical Atlantic ocean, three of which are Macrura: *Virbius acuminatus*, *Latreutes ensiferus*, *Leander tenuicornis*; two are Brachyura: *Neptunus sayi*, and *Nautilograpsus minutus*. The "Plankton" expedition found only these five species in the Sargasso Sea, and an examination of the reports of other expeditions, especially that of the "Challenger," shows that no other species were previously recorded.

The examination of the swimming and floating larvæ is very difficult, as generally they cannot be referred without doubt to the proper adult stages; also because some of them were erroneously identified by former authors, and, again, others were formerly described as fully developed animals. Larvæ of Euphausiacea and the lower Decapoda, especially the *Penæidæ*, are very common in the open sea, and their development is a free one in a very extreme degree, whilst the larvæ of higher Decapoda, in a more or less advanced state, leave the eggs carried by the females below the abdomen in the well-known manner. Some of the pelagic larvæ, es-

pecially those of the *Sergestidæ*, are provided with very characteristic larval appendages.

The larvæ of the higher Decapoda, except the Penæidea, may be divided into two groups, one of which shows during development a *Mysis*-stage characterized by the presence of exopodits (an outer swimming ramus), on the ambulatory or thoracic legs, in the other group such appendages never are observed. To the first group belong most of the Macrura, and to the second the Brachyura. In the old group of Anomura all the states of transition may be found. In most cases the proper systematic definition of the larvæ is impossible; only the larger divisions can be determined, very rarely the family.

As the larvæ of the Decapoda belong mostly to parents living on the shores, the horizontal distribution follows plainly the coasts of the oceans; they are a characteristic feature of the litoral "plankton," but by the agency of the oceanic currents they are often carried away from the coasts, and are found sometimes at a considerable distance from the land.

Within the Atlantic ocean the "Plankton" expedition crossed these two types of the "plankton" several times, the litoral, and that of the open sea. Besides, near the mouth of the Tocantins river, Brazil, a third type was observed, no doubt influenced by the peculiar conditions prevailing there being caused by the mingling sea water and the fresh water discharged by the Tocantins and Amazon rivers. The litoral "plankton" was examined in four localities: near the northern European coasts, in the Gulf Stream off the coast of United States, off the tropical western coast of Africa (Cape Verde Islands), and near the Brazilian coast. The litoral "plankton" of the Gulf Stream agrees very closely with that of the Brazilian coast, that of the two other localities contain some peculiar forms, varying with the different character of the relative litoral faunæ.

The true pelagic fauna is divided into a northern, or arctic, and a tropical province. In the latter may be distinguished the region of the currents (North and South equatorial current, Guinea current and Gulf Stream), and that of the relatively calm Sargasso Sea, but both are closely connected together, being distinguished principally by the differing quantity of pelagic animal life, which is more abundantly developed within the currents.

Summary of a report on the "Decapoda and Schizopoda," published in *Ergebnisse der Plankton-Expedition der Humboldt-Stiftung.*

A STUDY IN GREEK ARCHITECTURAL PROPORTIONS. THE TEMPLES OF SELINOUS.

By ALLAN MARQUAND.

It is commonly assumed that Greek architectural proportions varied in such a way from century to century that if we had before us the exact proportions of a building we might infer its approximate position in a chronological series. This assumption is a very fascinating one, since it extends the hope of reducing Greek architectural archæology to the basis of a science of mathematical exactness. And yet it is true that very little pains is usually taken to exhibit tables of measurements and proportions, and reliance is placed upon vague general impressions or upon a very scanty basis of measurements. What is known as Semper's norm has been very influential with the historians of Greek architecture. This norm consists in measuring the relative position of columns, and relating three average column distances to the height of the column and entablature. Having ascertained these measurements from a number of Greek temples, Semper made out, largely in ac-

cordance with this norm, a chronological series of temples. In criticism of Semper, we remark that the fractional form in which his norm is given is not practical, since the relation of fraction to fraction is not at first sight evident. The insufficiency of this norm is also apparent when we consider that a large number of other norms might be given, resulting in a series of a different character. In the present article, we have gathered for the five hexastyle temples at Selinous, measurements for various proportions of the ground-plan, elevation, column and entablature. These measurements we have related to each other in fifty-five different ways, so as to produce fifty-five different norms, classified as ground-plan norms, elevation norms, column norms and entablature norms. A consideration of these tables will show that these norms are very far from producing the same result; the instability, therefore, of trusting to a single norm becomes self-evident. We have, therefore, made another table in which all the norms for the separate classes are added together. It might be supposed that each of these classes would produce the same result, but this is not the case. Even combinations of norms are seen to be uncertain. We have, therefore, gathered together the sum of all the norms, and find that this results, in the present case, in the following conclusion: The oldest of these temples is that which has been called the temple C; but the second temple, D, approximates it so closely as to make us feel that the consideration of norms, in this instance, has but little value; the temple S, however, is separated by a large numerical difference from temples C and D on the one hand, and from R and A on the other. The sum of the norms, therefore, shows its transitional character. Temples R and A are usually placed in the same class, no attempt being made to distinguish a difference in age between them; but the sum of all the norms, however, points in favor of an earlier date for temple R. In conclusion we may remark that the determination of chronological sequence by means of data furnished by measurements is a laborious method of reaching a result which may be sometimes attained more quickly in other ways; but cases may arise when this method is the only decisive one. In such cases we maintain that the sum of a series of norms is more likely than a single norm to reach approximately certain results.

[Abstract of a paper in *Am. Jour. of Arch.*, Oct.-Dec., 1894.

REVIEWS OF BOOKS.

THE UNITED CHURCH OF THE UNITED STATES. By Charles Woodruff Shields, Professor in Princeton University. New York. Charles Scribner's Sons. 1895.

Dr. Shields has embodied in this volume, with exceptional dignity and grace of style, the conclusions he has reached, after large historical study and years of reflection, on a subject of the profoundest interest to every Christian scholar. He has given to the public a work of permanent importance; one, at least, that must be reckoned with by those who shall hereafter take up the difficult problem of church unity in the United States.

Whoever will examine Dr. Shields' earlier volumes will see in the aim and character of his literary work special elements of preparation for the study of this problem. He was one of the first of American writers to criticize with ability the Positivist classification of the sciences, and to construct an alternative scheme. He is the author of an extended treatise, the aim

of which is to show the possibility of the conciliation of the opposing philosophical tendencies in and by a higher unity which, if he does not attempt to formulate, he, at least, intimates. It should surprise no one to learn that the author of such a treatise has for a long time held steadily before himself, and at length unfolded to others—even while living in the midst of clashing denominations—the vision of a United Christian Church. Moreover, from the commencement of his professional life, he has been deeply interested in liturgics, and his taste and temper, as well as his reading, have made him value more and more highly the great prayers and hymns and offices, in which Old Catholic or, later, Western Christianity gave fixed literary expression to the deepest and, for that reason, the common supplications and aspirations of the Christian heart. One of his most valuable works is an edition of the Book of Common Prayer, which preserves the emendations proposed at the Savoy Conference by the Presbyterian divines; and which includes an essay intended to show the harmony between the Liturgy and the Westminster Directory for Worship. This volume appeared more than thirty years ago, and it shows the same irenic purpose and the same optimistic spirit that appear in his latest book. It also shows Dr. Shields a loyal and enthusiastic Presbyterian; but one who stands a wide interval apart from the Presbyterians who sympathize with the Independents' opposition to fixed forms on the ground, to use Milton's phrase, that "pre-written prayer has less sympathy and intercourse with the heart wherein it was not conceived."

Had these been his only preparations for the composition of the present volume; had he lacked interest in the Biblical and dogmatic questions, which, during recent years, have come forward for discussion, his ideal of church unity would have been a merely external and lifeless syncretism. But he has manifested a deep interest in both subjects. He has advocated high views touching the harmony between Biblical declarations and scientific discoveries. He has always been a consistent and pronounced Augustinian. And no writer could have been more chivalrous than he has been in defending Calvin's conduct in the case which has been made the basis of the most violent attacks upon his memory. It is the more important to say this, since, by not a few, evidently ill-informed about Dr. Shields' literary career, or about the liberty belonging to a Presbyterian minister to discuss freely a great question of church statesmanship, Dr. Shields has been regarded as, if not a disloyal, at least a very poor Presbyterian.

Such a writer could not fail, when writing on church unity, to produce a profoundly interesting book. I have not been offered space enough in which to present even a synopsis of his treatment of his subject. I can only assure my readers that they will find every chapter full of interesting matter. Dr. Shields is at his best, I think, in the sections in which he presents the consensus of belief and practice in the "United Churches of the United States," and commends the elements of what he calls the "Historic Liturgy." He says forcibly and clearly all that can be put forward in behalf of the "Historic Episcopate," as the chief external basis of the church unity he so ardently desires to promote. He does not, it seems to me, appreciate the objections which might be urged against it. I will mention only one of them. Dr. Shields' subject is Church Unity. His thesis is, that a condition *sine qua non* of church unity, as well as the great means of its promotion, is the employment of the "Historic Episcopate" in concurrent ordination. The only "Historic Episcopate" available for that purpose is the Anglican. But the Anglican Episcopate is not recog-

nized either as "historic," or indeed as an "Episcopate" by the only other churches which deem an Episcopate necessary to the church's existence. So far as the history of the last three hundred and fifty years teaches anything on this subject—and it is our only source of information,—it teaches that were the Anglican, the Greek and the Roman bishops to meet in council, and were the validity of ordination by Anglican bishops to be brought before the body, only the Anglican bishops themselves would declare in favor of the validity of their own orders. The Greek and Roman bishops, so far as we are able to judge, would vote that an Anglican bishop, not being a bishop, is incapable of conveying the grace of orders. That this is the Roman church's position is evinced by its reception of Father Newman, an Anglican Presbyter, and of Bishop Ives, an Anglican bishop, as penitents and laymen. This non-recognition of Anglican orders by any except themselves, among those who value orders conferred by the "Historic Episcopate" as peculiarly efficacious, would appear to be a serious, if not a fatal practical objection, at present, to concurrent ordination as a means to church unity.

The writer of this notice is unable to assent to some of the other cardinal statements of the volume; and were this an extended review, he would point them out and state the grounds of his dissent. But he prefers to employ the remaining space assigned him in expressing his conviction that Prof. Shields has given us a noble and useful volume. It has many qualities which entitle it to be described by these adjectives; the chief of all being the quality given to it by the fact that it has been written under the inspiration of the highest social ideal; the united and, therefore, conquering Church of God. People, who write for the purpose of expounding and defending high ideals, are too often nowadays thought of as "chasers of the rainbow." We may be thankful for the presence of such writers among us, and especially for their presence in University circles. For "where there is no vision the people perish." JOHN DEWITT.

A SCIENTIFIC FRENCH READER.—Edited with Introduction, Notes and Vocabulary, by Alexander W. Herdler, Instructor in Modern Languages, Princeton University. Boston, U. S. A. Ginn & Company, Publishers, 1894, 186 pp.

Ever since Newton set the example by abandoning Latin, which had up to his time been the common medium of communication among scientific men, and wrote one of his most important works, the Optics, in English, it has been the custom for each writer on Science to use his own language in his publications. It thus becomes necessary for anyone who wishes to be well informed on scientific matters to read with facility at least three languages, English, French and German. In view of the recent development of science in Italy, he is fortunate if he has command of Italian also. The scientific vocabulary is sufficiently remote from that of ordinary literature to make it desirable that a student who is preparing himself for scientific work should have some special instruction in it. To meet this want, so far as French is concerned, Mr. Herdler has prepared the little book under review. It contains extracts from various sources, mainly the articles in the *Revue Encyclopédique*, in which matters connected with Physics and Chemistry are treated in a popular way.

There are only a few instances in which fundamental questions are discussed, and in these there is an occasional lapse from scientific precision. Most of the articles deal with simple experiments, some of them of the style falsely called paradoxi-

cal, or with the applications of scientific knowledge in the arts.

The popular character of the citations renders them perhaps more entertaining to the reader than more severely accurate ones would have been, but it entails the omission of all mathematical terms, and of most of those connected with abstract mechanics.

There is sufficient variety in the subject matter to introduce a large number of the words which a student needs for his subsequent reading. Of such of these as are not found in the ordinary dictionaries, Mr. Herdler has prepared a vocabulary, which will be of value to the beginner. The notes are chiefly biographical and descriptive. W. F. MAGIE.

HERNANI. A Drama, by Victor Hugo. Edited, with Notes and an Essay on Victor Hugo, by George McLean Harper, Ph.D. Pp. xlvii + 126. Henry Holt & Co.

The literary history of France during the century which is now drawing to its close, presents many features of widely different interest. For not only has there been a constant shifting of literary tendencies and a continual change of merely literary ideals, but the political life of the nation has had so marked an influence on the productions of its world of letters that the latter acquire a peculiar degree of significance. This assertion by no means implies that the course of France's literary development can be directly traced by following the history of her political upheavals, or *vice versa*,—in fact, Professor Harper expressly assures us that this is impossible,—but the two are certainly so closely connected that the study of one throws much light on the character of the other.

In the somewhat elaborate essay which occupies the first forty pages of the present volume, Professor Harper gives a synopsis of France's literary history during the past eighty years, with such occasional excursions into the field of political events as may serve for fuller explanation of concurrent literary phenomena. As the title of the work indicates, the greater portion of the essay is devoted to an account of Victor Hugo's life and a criticism of his works. More than any other one man of his century, Victor Hugo was representative of the course of French literary history since the fall of Napoleon, and an outline of the several stages of his development affords an excellent opportunity for discussing nearly all the literary problems which agitated the age in which he lived.

The present essay accordingly brings before us in rapid review the intellectual condition of France under the First Empire, with brief accounts of the lives and writings of Chateaubriand, Lamartine and Lamennais; the reaction, after the events of 1815, in favor of Monarchy and Romanism, led by the above writers together with the then youthful Hugo; the development of the Romantic movement in France, and an account of its conflict with Classicism; a discussion of the essential character of Romanticism; the literary results of the July Revolution of 1830, and Hugo's consequent tendency towards Republicanism; the revolt against conventionality in the literary côterie to which belonged, besides Hugo, Alfred de Musset, Béranger, de Vigny, Balzac, George Sand, Dumas, and Sainte-Beuve, with brief characterizations of these several writers; and, finally, several pages about Victor Hugo himself, and a few comments on some well-known English criticisms of him.

The book also contains the text of Victor Hugo's drama *Hernani* (reprinted from the Édition Définitive of 1880), prefaced by a short historical introduction and followed by critical and explanatory notes. A portrait of Victor Hugo forms an attractive frontispiece, and the whole volume does credit to its publishers as well as to its editor. W. H.

NOTES.

RECENT ADDITIONS TO THE HERBARIUM.

The Herbarium of the School of Science has lately received three gifts of plants which add a number of valuable specimens to our already representative collection in the School of Science.

Mr. J. B. Hatcher, of the Palæontological Museum, presented his collection, consisting of some 1,400 sheets of carefully named and mounted specimens. This comprises many of the common species of the Flora of Connecticut, and also of Nebraska and Dakota. The gift is, however, especially valuable in that it includes a very full and choice collection of mosses, a large number of which are from the Hawaiian Islands. Many of these mosses, as well as some of our native ones, are rare, and they thus form a very desirable and noteworthy addition to this part of the Herbarium.

The Princeton Scientific Expedition of last summer also added to the Herbarium a number of specimens collected by Messrs. Hatcher, Moses and Brooks, in the region of the Big Horn Mountains, Wyoming. These, when determined and arranged, will prove a valuable supplement to the collection brought back by the Expedition of 1877.

Through Prof. Libbey the Herbarium has been enriched by a complete set of the plants collected last summer in North Greenland, by Mr. E. B. Baldwin, of the Peary Expedition. This collection has been worked up by Prof. Macloskie, who describes some of its interesting features in this number of the BULLETIN.

It has also received from Mr. H. G. Bryant, of the class of '83, Director of the Peary Auxiliary Expedition of 1894, a complete set of the plants collected in Greenland by Dr. H. E. Wetherill, the Botanist of the Expedition, and carefully worked out and named in the Herbarium of Harvard University.

W. M. RANKIN.

GREENLAND PLANTS.

Our Princeton Herbarium has recently received two collections of plants from the Peary Auxiliary Expedition of last summer. The first of these, made by E. B. Baldwin, contains a large number of specimens belonging to 26 species, many of them beautiful specimens, and all collected in North Greenland. The second donation is a set, the choice set, we may say, out of six, which were prepared and named in the Harvard Herbarium from the collection made by Dr. H. E. Wetherill, and have been presented to his *Alma Mater* by Henry G. Bryant, of the class of '83, who was Director of the Peary Auxiliary Expedition. Our Prof. Libbey, who accompanied Mr. Bryant, has also followed his usual custom of bringing back valuable specimens of animal life for the Museum. The Wetherill collection contains 119 specimens, representing 70 species, of 22 orders, duplicating most of the species of the Baldwin collection, with about fifty other species. All the plants now brought from North Greenland were previously known from South Greenland, excepting a very few; and these exceptions are known from northern coasts of North America. The North Greenland flora appears to consist chiefly of stragglers from South Greenland, just as the flora of South Greenland is derived from that of Arctic America and of Arctic Scandinavia; or it may consist of surviving fragments of an earlier vegetation which was spread over the Northern Lands when under a favorable climate. All the plants are dwarf, some of them so much reduced

in size, and the leaves crowded together or covered with silvery hairs, that it is difficult to determine them; thus I found it impossible to separate the specimens of Potentilla which were in the Baldwin collection and which are assigned by the Harvard botanist to two species and a variety of one of them. The tallest specimen was a fern (*Aspidium fragrans*, Swartz), which is fully a span high. The trees are represented by a willow (*Salix glauca*, L.), which is six inches high, with leaves in masses here and there on the otherwise naked stem; and by a Rhododendron (*R. lapponicum*, Wahl.) about four inches high, remarkable for its beautiful flowers. The Baldwin collection has a large supply of this species, but it is not in the Wetherill collection. The largest of the herbs is a poppy (*Papaver nudicaule*, L.) with solitary, shining, yellowish flowers surmounting a 4-inch leafless stalk. *Dryas octopetala*, L., a conspicuous plant in the Rocky Mountains, is here represented abundantly by a smaller form, a variety *integrifolia*. The saxifrages are abundant, as they usually are in cold regions: two of them, *Saxifraga caespitosa* and *S. oppositifolia*, being very unlike the usual habit of the genus. The stem and leaves of *Saxifraga oppositifolia* resemble a large moss-plant. In this and in many others of the collection, the leaves are crowded on each other along the stem, so as to shelter one another from the extreme cold; just as in other species the same shelter is secured by the leaves being close to the ground, whilst only the flowers rise a little higher. The circumstance that many of the species have shining flowers, suggests that even in that cold region the services of insects may be called into requisition for fertilization.

In the following list an asterisk (*) indicates that the species is represented only in Dr. Wetherill's collection, a dagger (†) that it is only in Mr. Baldwin's collection; the unmarked species are common to both collections:

Order Ranunculaceæ.
- Ranunculus nivalis, *L.**
- " pygmaeus, *Wahl.**

Ord. Papaveraceæ.
- Papaver nudicaule, var. arcticum, *Elk.*

Ord. Cruciferæ.
- Draba fladnizensis, *Wulf.*
- " alpina, *L.**
- " incana, *L.**
- " hirta, *L.*†
- Cochlearia groenlandica, *L.* new var. oblongifolia.*
- Cochlearia fenestrata, *R. Br.**
- Arabis alpina, L.*
- Lesquerella arctica, *Wats.*

Ord. Caryophyllaceæ.
- Silene acaulis, *L.*
- Lychnis apetala, *L.*
- " triflora, *R. Br.**
- Stellaria humifusa, *Rottb.**
- " longipes, *Goldie.*
- " " var. Edwardsii, *T. & G.**
- Stellaria media, *Cyr.**
- Arenaria groenlandica, *Spreng.*†
- Cerastium alpinum, *L.*

Ord. Rosaceæ.
- Dryas octopetala, var. integrifolia, *C. & S.*
- Potentilla emarginata, *Pursh.*
- " nivea, *L.**
- " " var. Valiliana, *Lehm.*
- Sibbaldia procumbens, *L.**

Ord. Saxifragaceæ.
- Saxifraga nivalis, *L.*
- " cernua, *L.**
- " caespitosa, *L.*
- " oppositifolia, *L.*
- " tricuspidata, *Retz.**

Ord. Onagraceæ.
- Epilobium latifolium, *L.**
- " angustifolium, *L.**

Ord. Compositæ.
- Arnica alpina, *Olin.*

Antennaria alpina, *Gaert.**
Taraxacum officinale, *Weber.*
" " var. lividum, *Koch.*

Ord. Ericaceæ.
Vaccinium uliginosum, var. mucronatum, *Herder.*
Cassiope tetragona, *Don.*
Rhododendron lapponicum, *Wahl.*†
Bryanthes taxifolius, *Gray.*
Pyrola rotundifolia, var. pumila, *Hook.*

Ord. Plumbaginaceæ.
Armeria vulgaris, *Willd.**

Ord. Scrophulariaceæ.
Pedicularis flammea, *L.*
" lapponica, *L.**
" Langsdorffii, var. lanata, *Gray.**
Pedicularis hirsuta, *L.**

Ord. Borraginaceæ.
Mertensia maritima, *Don.**

Ord. Diapensiaceæ.
Diapensia lapponica, *L.**

Ord. Polygonaceæ.
Oxyria digyna, *Hill.*
Polygonum viviparum, *L.**

Ord. Salicaceæ.
Salix glauca, *L.* var.
" Brownii, *Bebb.* var. ad S. glauca.

Ord. Betulaceæ.
Betula nana, *L.**

Ord. Empetraceæ.
Empretrum nigrum, *L.**

Ord. Juncaceæ.
Luzula arcuata, *Meyer.**
Tofieldia palustris, *Huds.**

Ord. Cyperaceæ.
Eriophorum polystachion, L.*
" Scheuchzerii, *Hoppe.*
" vaginatum, *L.*†
Carex nardina, *Fries.*
" rigida, var. goodenovii, *Bailey.**
Carex pygmaea, *Wahl.*

Ord. Gramineæ.
Alopecurus alpinus, *Sm.**
Poa alpina, *L.**
" abbreviata, *R. Br.*
Arctagrostis latifolium, *Ledeb.**
Calamagrostis phragmatoides, *Hartm.**
Trisetum subspicatum, var. molle, *Gray.**
Festuca ovina, var. brevifolia, *Wats.**

Ord. Filices.
Aspidium fragrans, *Swartz.*
" spinulosum, var. dilatatum, *Hook.**
Cystopteris fragilis, *Bernh.**

Ord. Lycopodiaceæ.
Lycopodium Selago, L.

G. Macloskie.

May 3, 1895.

CORRECTION.

I am informed by Prof. Blaikie, of Edinburgh, that "The Wheat and the Chaff Gathered into Bundles," being No. 5 of the McCosh Bibliography in the last Bulletin, is not the work of the late President of Princeton College; but of another James McCosh, an editor in Dundee, Scotland. The title was taken from the card catalogue of the Princeton Seminary Library, the book itself having been mislaid.

J. H. Dulles.

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THE DODGE MEMORIAL WINDOWS.

Princeton College Bulletin.

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THE DODGE MEMORIAL WINDOWS.

If we wished to draw a distinction between the past and the present Princeton, the difference could not be illustrated better than by pointing to the Old Chapel and the New. In all that is essential to the religious life of the college there has been no break, but a change is nevertheless manifest. This has been more than an outward change in the manners of the worshipping body; it has reached the spirit. In a single word the Old Chapel and the old life were without charm, the new possesses it. This charm is largely due to the influence of beautiful surroundings. The chapel itself is a good example of the work of our most distinguished architect Richard M. Hunt; the McCosh memorial presents to our eyes, not only the form of an honored president, but also the workmanship of our ablest sculptor, Augustus St. Gaudens; the Joseph Henry and the Arnold Guyot memorials do honor also to the sculptors Louis St. Gaudens and Olin L. Warner.

By no means an unimportant element in the charm of the chapel are the mosaic and painted glass windows. The small windows in the apse by John La Farge, are fine examples of his skillful combination of brilliant colors. The large rose windows are by Louis C. Tiffany, who holds a high rank in his profession. And now on either side of the chapel, beneath the rose windows, are groups of windows dedicated to two young graduates who lived but a few years after their college course was ended. One of these was Frederick Alexander Marquand, of the class of '76, the other, William Earl Dodge, of the class of '79. There are many here who will remember them during their college life, for they were leaders amongst their fellows. Gifted with unusual personal charm, with their energies devoted to the highest ends, they did much to help those about them to higher standards of life. The two groups of memorial windows have been executed by the same artist, Francis Lathrop, of New York.

The Marquand windows have been already described in this Bulletin, Vol. II, No. 1. The Dodge windows, which have only recently been put in place, are very rich in color; the mauve and blue of the side windows, and the olive green of the central group, having been selected so as to harmonize with the prevailing tones of the rose window above. The angels on either side are symbolical of the character commemorated. One is an Angel of Hope, bearing a spray of Annunciation or Easter lilies and a scroll on which is inscribed, IN TE DOMINE SPERAVI (Ps. 31.1). On the other side is an Angel

of Triumph, bearing a palm branch of victory and a scroll with the words, TE DEUM LAUDAMUS. Through the central windows runs the inscription from the opening of the 148th Psalm, PRAISE YE THE LORD FROM THE HEAVENS, PRAISE HIM IN THE HEIGHTS; PRAISE YE HIM ALL HIS ANGELS; PRAISE YE HIM ALL HIS HOSTS. These words, so well selected and enshrined in windows of unusual beauty, are a welcome memorial of one whose brief life was full of hope and praise and triumph.

THE APPROACHING SESQUICENTENNIAL CELEBRATION.

In accordance with the report of a committee of the Faculty, the Board of Trustees has determined the one hundred and fiftieth anniversary day of the founding of the College to be Thursday, October 22d, 1896, inasmuch as the first charter was granted on October 22d, 1746. It is now proposed to celebrate this sesquicentennial anniversary by an impressive academic festival, by raising a large endowment both for college and university work and by formally assuming the university title. In order to carry out these projects the Trustees have appointed three committees, one to examine the legal questions connected with the change of title, another to organize the academic celebration and a third to secure the needed endowments. The business of the committee on the legal questions involved is principally to decide whether additional legislation is necessary in order that the title of Princeton University may be assumed. The business of the Committee on the Sesquicentennial Celebration is to arrange and execute a programme for the academic festival. It is intended to make this festival a dignified and impressive celebration, one which shall in every way be worthy of Princeton. As the programme has not yet been adopted it is impossible to speak of precise details. However, it is very probable that the festival will be held on Tuesday, October 20th, Wednesday, October 21st and Thursday, October 22d, 1896. It is desired that all the living alumni of Princeton class by class shall be present, so far as it is possible for them to come. Representatives of other American colleges and universities are to be invited and it is hoped that there may be distinguished representatives from some of the Old World universities. Special attention will be given to the alumni and student side of the celebration, as well as to the more strictly academic features. A programme will be provisionally adopted at an early day, but not announced until it is fully matured. The business of the Committee on Endowment is of course obvious. It is proposed to strengthen both the undergraduate college instruction and develop strongly the university side. The future of Princeton is not purely a college future nor purely a university future. It is in the development of a fine graduate university resting upon a great undergraduate basis that the best future of Princeton lies. In planning for the endowment these considerations have been held in view and the emphasis has been put on fundamental things, namely, an increased staff of the very ablest professors obtainable, a large university library in addition to what we now have and a considerable number of well endowed university fellowships and scholarships. The opportunity is a very great one, perhaps the greatest in the history of Princeton.

The principal part of the work falls upon the Committee on the Sesquicentennial Celebration and the Committee on Endowment. The Chairman of the former Committee is Mr. Charles E. Green and the Chairman of the Endowment Committee is Mr. James W. Alexander, and President

Patton is a member of both committees. In order to secure concert of action and organization in both committees it has been felt desirable that there should be one Secretary for both. Accordingly Professor West has been temporarily relieved of his professorial duties in order to devote himself entirely to this work. Fuller announcement of the composition of the committees, which is not yet entirely completed, and of the proposed programme, and also of the specific objects for which endowments will be asked, will be made from time to time to the alumni and other friends of the college.

THE RELATIONS OF THE GULF STREAM AND THE LABRADOR CURRENT.

By WILLIAM LIBBEY, JR.

During the summer of 1890 and 1891 work was continued in the same area of water off the southern New England coast, as in 1889, the same limitations, east and west, and north and south, being observed, except that in 1890 the lines run by the Coast Survey steamer Blake extended 20 miles farther out to sea than usual, or a total distance of 150 miles.

As the steamer Blake could not be spared for this purpose in 1891, the parties upon the schooner Grampus and the Nantucket New South Shoal Light Ship were the only ones in the field. As it was considered inadvisable to make a regular series of observations over the entire area this year, such lines were chosen as would serve to bring out the essential character of conditions supposed to exist. Each line run, however, was equivalent to one that had been utilized in previous years, but the distance between the lines was greater. The schooner Grampus occupied 148 stations along 13 such lines, making a total of about 1500 serial temperature observations upon the water, and over 300 determinations of its specific gravity. In the same connection over 11,000 hourly meteorological observations were recorded. The light ship party was on duty from July 3rd to August 17th, during which time it made 500 serial temperature and 250 specific gravity observations upon the water, besides a special series of over 1000 hourly determinations of specific gravity. The hourly observations respecting meteorological conditions by this party amounted to 17,000. The total number of observations made in 1891 was, therefore, 32,000, as compared with 39,000 in the previous year, when three parties were at work.

The relations of the Gulf Stream to the Labrador current, as brought out by this study, are especially interesting because of their bearing upon the migrations of schools of fishes. The region off the southern coast of New England was chosen for this inquiry because it was supposed that the contrasts between the currents would be more distinctly shown there, from the fact of their being forced closer together by the projection of the mainland to the southwest from its general curve. This expectation was realized in the course of our investigations.

The 50° curve of temperature obtained by plotting the observations made at the different stations has been a most interesting one from the beginning. It has been the means of demonstrating the fact that there are two sets of conditions under which these two distinct bodies of water come into contact. It will be convenient to speak of these two portions of the main current of the Gulf Stream separately, under two headings, namely, the upper portion and the lower portion.

Upper Portion.—The boundary between the cold and warm waters at the surface is very seldom a straight line, perpen-

dicular to the surface of the water. It marks the position of the resultant of all the forces at work. Of course, the general position of the boundary will be determined by the velocities of the two bodies of water and their direction when they come in contact. If we leave out of consideration, for the present, the wind as an effective agent in the production and directing of the ocean currents, we find that in addition, it becomes a most potent factor in the causation of the changes which are produced in the position of the boundary line at the surface. The winds certainly sway the surface waters of these currents one way or another; just as they may retard or reinforce them in their general direction.

The winds which blow over this portion of the North Atlantic may, for convenience, be divided into two classes. One may be said to blow in a southeasterly direction and the other in a northwesterly direction. The general tendency of the first group or summer set, will be to drive the warmer waters at the surface toward the coast; thus forcing them above the colder waters of the Labrador Current. The other, or winter set, may be considered to have the opposite effect upon these waters, and the final position reached after a cycle is completed will depend on the relative velocities of the winds. It is not denied that there are other factors which enter into this result, or that this position is affected by the physical character of the waters, viz: their relative temperatures, densities, etc., but it is claimed, that after due allowance is made for these other factors, the winds are the most active causes of the daily and seasonal variations which take place in the position of this boundary.

While these motions may equalize one another and the resultant position remain the same from year to year, it is supposable that there may be an excess in one or the other of these directions for a series of years, with the result that the boundary will be carried far from its normal position in one direction or the other, and thus mask the true position of the main body of one or the other of these currents to a very considerable extent.

Lower Portion.—It might be expected that in this position only the general causes which produce and modify the currents in the oceans could bring about any change in either their velocity or their direction. But there is no doubt that the cumulative effect of long continued impulses, as described above, resulting in each case in a gain in one or the other of these directions will ultimately be felt, and the result will be seen in a change of position of the main mass of the current. When these changes are brought about, they are of such a character as to evade detection, unless the averages of many observations are carefully studied, when the change in the position of the resultant becomes manifest. The contrast between these two portions of the current are seen in the apparently more flexible character of the upper portion as compared with the lower, the former being characterized by rather rapid changes in position, the latter by much slower motions.

The 50° line indicates very clearly the changes which take place in the relations of these currents. During the time when we were engaged upon this subject its predominant shape was that of an inverted letter S. The lower part of the inverted letter representing the main body or lower portion of the Gulf Stream. Neither the 40° line nor the 60° line show any great deflections under any circumstances, thus apparently indicating that they are well within the boundaries of each of the main bodies of their respective currents.

A study of the temperature profiles obtained in 1891, showed that the general

relations of the currents had remained the same, but it was noticed that during the greater part of the time the curved bend of the lower part of the 50° line touched the edge of the continental platform, covering it completely from the depth of 70 fathoms to that of 120 fathoms in different places. This had occurred once or twice in 1890, but it was then believed to be rather an accidental feature than otherwise.

A comparison of the profiles of the three years revealed the fact that there had been a progessive motion during that period toward the shore. In 1889 the lower portion of the curve did not touch the edge of the continental platform at any point within the area we were studying. In 1890 this portion of the curve touched the continental edge both at Block Island and off Nantucket Island, in the latter part of the season; and in 1891, as has been said, it touched along the whole edge of this portion of the platform during the greater part of the summer. The change which was thus produced in the temperature at the bottom, along this edge of the continental platform was in the neighborhood of 10°, an item of considerable importance.

The effect produced by this change in temperature and its relations to the work of the Fish Commission can be seen to best advantage by reference to a very interesting problem in Biology with which it has a direct connection. At a conference held in Washington with the Commissioner of Fisheries the results obtained were carefully discussed. We saw very plainly that if the same rate of motion held good during this year the whole of the continental edge, or at least that portion of it with which we were most directly concerned, would be covered with this warmer water. The idea was then suggested that if such were the case, the conditions for the reappearance of the tile fish would be established if environment meant anything in the problem. In the years 1880 and 1881 this recently discovered fish had been found in considerable numbers upon the area we were studying and had attracted so much attention among fishermen that preparations were made to take it upon a commercial scale for the New York and Boston markets during the ensuing season. Unfortunately, however, in the spring of 1882 the water from Cape May to Nantucket became covered with countless millions of this fish in a dead or dying condition. From that time the tile fish (Lopholatilus chamæleonticeps) disappeared from this area entirely, and all attempts to find it since then have been unsuccessful. The cause of its disappearance became a sort of Biological puzzle.

The fish had previously been caught in a depth of water varying from 60 to 130 fathoms. Its feeding ground being at the bottom, would therefore occur just at the edge of the continental platform. It is probably a tropical deep sea species, judging from its relationships, which had migrated northward through favorable inducements offered by an enlarged feeding ground opened up in that direction. It is noteworthy that the temperature at which it was caught (50° to 58°) could only be established on the New England coast and at the edge of the continental platform by just such an invasion of warm water as has been described above. It is only necessary to conceive the whole of the continental edge from Florida to Nantucket thus overflowed by this warm band of water to see how the regular feeding ground of a tropical species could be extended so that the fish could follow it throughout the whole of this largely increased area.

It was agreed to test these theoretical conclusions during the summer of 1892. In July the Commissioner and myself

went out in the schooner Grampus, south of Martha's Vineyard, to the area which seemed to promise a reward for our labors. We found the temperature conditions right, set the cod trawls and caught the tilefish. During the remaining portion of the summer I spent considerable time tracing out the limits of the area over which the temperature of 50° and above could be found; using the trawl lines at the same time to ascertain if the fish were there. We found them all the way to the Delaware capes, and were satisfied that though they were not numerous, they had taken advantage of the changed conditions to re-occupy this area.

The explanation of the disappearance of the tilefish in 1882 seems now to be a comparatively simple matter. If we suppose this area to have been flooded by warm water in the years previous to that date in the manner suggested above, it is easy to see that when this warm band receded, the first break in its continuity would occur in that extreme part of the bend lying between Cape May and Nantucket. The fish over this portion of the bottom would, in the event of the withdrawal of the warm water, be suddenly exposed to a bath of water of a sufficient degree of coolness to benumb them and start them on their way to the surface. After they had reached a point in the water which marked the limit of their adjustment to pressure, they were bound to go the rest of the way to the surface, where they arrived in an abnormal condition, as their bodies were all puffed up, and in most instances their stomachs protruded from their mouths as a result of the diminution of pressure. It is an extremely interesting fact that the dead bodies of these fish came to the surface in a long crescent-like curve which followed the line of the edge of the continental platform between Cape May and Nantucket. These temperature studies of this area, may therefore, be said to have made an interesting contribution to the study of environment.

IMPRESSIONS OF YUCATAN.

By ALLAN MARQUAND.

When my friend Allison V. Armour proposed that I should go with him to Yucatan on his steam yacht, the Ituna, the opportunity was too attractive to be resisted. So I put my photographic apparatus in order and brought out my gun, and considered myself prepared for the excursion. But Armour's intentions were more serious than my own. He had invited an archæologist, W. H. Holmes, and a botanist, C. F. Millspaugh, both of the Field Columbian Museum of Chicago. These gentleman came prepared with instruments for surveying, drawing and photography; with glass jars and copper canisters for the preservation of the fauna and presses for the flora of the country. In fact I found myself embarked upon a scientific expedition. At Progresso we were joined by Edward H. Thompson, whose ten years residence in Yucatan had given him no small amount of knowledge of the people and the country, and whose archæological enthusiasm has tempted him to remain there for at least ten years more. He has already visited more ruins than any previous explorer, copied inscriptions and paintings, and photographed buildings and sculptures. When Thompson has produced his *magnum opus*, he will doubtless put into it more abundant and exact information concerning the ruins of Yucatan than can be found in the pages of other writers.

The railroad journey through our southern states was full of novelty to me. From the train I caught fleeting glimpses of the cotton fields of North Carolina, of the swamp lands of South Carolina, of the Georgia pines and the semi-tropical foli-

age of Florida. St. Augustine, somewhat familiar from photographs, was a revelation; especially Mr. Flagler's St. Augustine, magnificent with imposing hotels and churches.

From Jacksonville we had two days steaming over smooth waters to Havana, in whose beautiful harbor we spent Christmas. There was much here to attract attention: the old Spanish fort *Il Morro* and the adjoining *Cabañas* (prisons), the houses in light and varied colors along the shore, the bay alive with steamers from different countries and little sail boats with awnings plying to and from the wharves. An English man-of-war appeared in the morning with Christmas greens attached to her masts, while we presented a gay appearance with our signals looped from bow to stern. Havana itself was dusty and dirty, the streets narrow and the buildings, in general, uninteresting. The open porches, the awnings drawn over the narrow streets, the high ceilings, all speak of a warm climate, so also do the negligee costumes of the people. In spite of its rich fruit markets and busy cigar factories, Havana impresses a stranger as a large colonial town, a reflection of distant Spain, without independence or individuality or substantial evidence of civic pride. A visitor from the north is also struck with the iron gratings which guard the doors and windows of private houses; artificial barriers, for these homes contain little real privacy. The lover finds no difficulty in plying his suit through the gratings, until he is finally admitted to the approval of the family. Even in the opera house the so called private boxes have at the rear open wooden shutters, through which the populace may gaze to their heart's content upon the bronzed beauties within. We soon caught the spirit of the country, selected the box of greatest interest and gazed. The fair occupant evinced no sign of embarrassment.

When Christmas was over we started for Yucatan. Dark clouds were threatening in the north and before many hours we experienced a "Norther," the tempestuous wintry wind which is a terror to the sailors in the Gulf. We considered it prudent, if not necesary, to remain in our berths until our destination was reached. We were scoffed by porpoises dancing about the bow and by huge turtles floating on the sea, but were glad when the winds subsided enough to permit of casting our two anchors, though we were still three miles from the shore. Here we were obliged to await the visit of the health officer, who did not venture out until the following day.

Progresso is a small town, important only as the seaport of Merida. Compared with other places in Yucatan, it is devoid of interest, except such as attends the loading and unloading of vessels. Before leaving home, I had received a letter from a friend who wrote, "My only knowledge of Yucatan is of Progresso, where I stopped a few hours. My chief recollection is of a huge live turtle kept in the back of the hotel, from whose flesh meat is periodically cut to supply soup to passing travellers." As the above mentioned friend is an officer of a prominent religious organization in New York, I was credulous enough to half believe his written testimony. However, wishing to ascertain whether this curiosity were still alive, I made inquiries in my best Spanish. But this failed to produce the animal. A day or two later I returned to the same restaurant, when a turtle was produced as the one for which I had inquired. There was no evidence of his having supplied other parties with turtle soup, but I may take this opportunity of informing the Society for the Prevention of Cruelty to Animals that we took especial pains to send the turtle of Progresso to the place where all good turtles go.

From Progresso we took the train to Merida, a city of some 60,000 inhabitants, the capital of the State of Yucatan. On either side of the railroad are henequin (hemp) plantations. Henequin, the foundation of the wealth of many of the prominent Yucatan families, has recently been cultivated in such abundance as to plethorize the market. Several financial failures have been the consequence. The plant resembles the century plant, with its stiff lanceolate leaves. It is allowed to grow for the first five years, when the lower leaves from which the hemp is made are cut. This process continues until the life is gone. The bales of clean, cream-colored hemp offer fine cargoes for the many ships which touch at Progresso. The tide of exportation for the present would seem to be turning, for the Ward line steamer on which I returned carried 1,000 bales to Havana and only 100 to New York.

Merida impresses us as a thoroughly foreign town, without that touch of Americanism which is perceptible in Havana. The houses in Merida are almost without exception single storied and flat roofed. They have fronts of stucco, painted in light colors, with Spanish and occasionally Moorish decoration. The rooms are arranged around a central *patio* or courtyard; high ceilings, cement floors, large doors and windows keep the interiors as cool as possible. Here and through the city are open spaces or *plazas* of painfully regular design. The Cathedral is an immense mass, uninteresting externally, but with an impressive interior of transitional, Gothic-Renaissance character. The subsidiary decorations, chiefly sculptural, are exaggerated and without character. During the services there seemed to be on the part of the people, a spirit of absolute devotion.

An important element in the life of the people is furnished by the theatre. The Teatro Peon Contreres is engaged by an opera company during the winter months. The lighter operas, Italian and French, are the favorites. The house and the costumes are on a simpler scale than at Havana, and a genuine love of music, or at least a hearty appreciation of its lighter phases, seems to prevail. Applause is quite unrestrained. A third centre of interest is the market place, where one is introduced to that most interesting class of people, the Mestizos. These people are the product of the Maya or native Indian and of Spanish blood, a crossing which seems to have been highly successful in preserving the virtues rather than the vices of both races. They have the sturdiness and simplicity of a pure, native stock to which is added a charm of manner seldom found in a laboring class. Above all they are a cleanly people, even in districts where water is to be obtained with difficulty. Their cheerful faces, fine white teeth, well shaped hands and bronze skins are emphasized by the use of white costumes. The attire of the men consists in a white shirt which hangs over a pair of white trousers. The women wear a loose tunic, embroidered at the neck and edges, over an underskirt. These costumes are cool, practical and picturesque. The women also wear a *reboza* or scarf about their heads and shoulders. and when going to a dance put satin slippers over their brown feet. In the cool winter mornings men are seen with a *sarape* or shawl, usually striped red and white, wound around their shoulders. These men are capable of carrying heavy burdens for long distances, sometimes making use of a strap across the forehead to relieve the weight upon their backs. When the work of the day is over they wash and array themselves with clean garments. When employed as domestics they are treated more familiarly than is customary with us. The women of a Yucatecan family may be seen gazing through the gratings of the window upon the street,

while the domestics occupy an adjoining widow of the same room. When one says good bye in Yucatan he shakes hands with the servants also.

The Mestizos have conserved in many ways the traditions of the Maya race. Except in certain localities they speak among themselves the Maya language, and live and dress according to the customs of their ancestors. The houses in which they live are fundamentally Mayan in type, and Spanish only in minor details. These houses may be seen on the outskirts of Merida and in all the country towns. We did not penetrate into the region of the hostile Sublevados, where the pure blooded Indians live, but I am informed that their houses are essentially the same as those of the Mestizos. The general type and its changes may be easily traced. In its simpler forms we may speak of these houses as belonging to the Rod and Leaf style of architecture. Rods in juxtaposition form the walls and a frame work of rods supports a thatched roof of palmetto leaves. The ground plan is usually oval, frequently rectangular, rarely circular. A more advanced stage of architecture consists in covering the rod walls with a red mud mixed with straw, thus securing greater protection from the weather. The third stage substitutes rubble walls for rods and cement for mud. If we may generalize from a single instance, the wall paintings in the building adjoining the tennis court at Chichen-Itza tell us that the ancient Mayas made frequent use of porches in front of their houses. Under these porches stone benches were probably arranged, as we may infer from their use in scattered cases to-day. It is not unlikely that the introduction of chairs by the Spaniards drove these stone benches out of fashion, and that the spreading walls in front of Mestizo houses are the last survival of the benched porticos of the past.

The invasion of our mechanical civilization is already beginning to make itself felt. After the railroad and the telegraph, there have already appeared roofs of tile and of corrugated iron, and the Chicago aermotor in place of human and animal labor at the well. Stamped cotton goods are beginning to vie with embroidered handiwork and the day may not be far distant when the high-heeled satin slippers will be followed by the entire European costume.

From Merida we determined to take advantage of calm weather to make a trip to the Eastern coast of Yucatan. A Norwegian schooner had been wrecked off cape Catoche only six days before, hence we proceeded with more than usual caution. The sea was calm and little crabs were floating on the surface in great abundance. We soon netted enough for a hearty meal. By the side of the wrecked vessel we found on guard a detachment from the Custom House of the Island of Mugeres. As this was our destination and the evening was drawing on we offered the gentlemen a tow. This they gladly accepted. The "Dago" pilot was unaccustomed to vessels larger than his own and we had the uncomfortable sensation of experiencing several hard rubs against the rocks. Transferring our confidence to the sounding line we stealthily approached the island and anchored off Dolores. This village is hardly more than a resting place for Cuban fishermen, but most picturesque with its thatched houses in the midst of cocoanut palms. The coraline rocks of the shore have been washed into strange shapes and it gave us a far-away sensation to watch the lizards and large iguanas crawling over the rocks. The water here and at Cozumel is of matchless clearness. We could easily see the corals and fish at six or seven fathoms from the surface and at moonlight our little launch floating on the transparent water seemed as if suspended in free air.

In this district we visited the ruins at

the end of the island of Mugeres, the group of ruins on the mainland at Il Meco, the much injured remains at the island of Caneum and ruins on the island of Cozumel. Our ethnologist took careful measurements and applied himself to the study of the general disposition of the ancient buildings, while we occupied ourselves with photography, shooting, gathering orchids and other plants. Mugeres and Meco and Cozumel are all supposed to have been important religious centers in antiquity, though little evidence of this now remains. The ruins reveal no buildings of stately character. They are all comparatively small and almost entirely without sculptural adornment.

Our eyes were constantly delighted by the wealth of color about us. The sea with its pale and dark greens, its purples and blues produced even more brilliant and beautiful effects than does the Mediterranean about the coast of Sicily. Even the fish seem to catch the spirit of their environment and deck themselves in bright colors. The woods with their soft grays and greens were less brilliant than they are in May or October, but even in January display a great variety of color, on their trunks are variegated lichens and in their branches are seen orange and black orioles, blue jays, green paroquets and red crested wood peckers. Along the shore we saw white herons standing and many an awkward pelican plunging into the sea for food.

The Yucatecans, especially the Mestizos, are very fond of dancing. Almost everywhere we found a 'baille' (ball) scheduled for the evening. At Cozumel a dance was announced entitled "Reminiscences of the Winds." This promised to be interesting and we went hoping to find some survival of ancient Maya practice. But only the name survived. The dances were altogether Spanish. Still it was picturesque. The ball room was a thatched structure open on all sides to the winds. It served also as a sanctuary. Before the dance came *Il Rosario*, in which the women officiated on their knees in harsh voices chanting the evening service. The men were listlessly gathered at the other end of the room or standing near an improvised bar. After the religious ceremony came the dances, the short stepped waltz and the *sapateo*, a species of jig or elementary quadrille. In the latter dance two young men represented their sex, the patron of the ball furnishing them with partners in regular order. Thus there were no wall flowers and every girl was sure of a partner for at least one dance. The utmost freedom from conventionality prevailed. The old women smoked their cigarettes, the young mothers nursed their children, the men took their drinks and yet the entire proceeding was orderly. The union of the religious service and amusement in this case seemed primitive and not inharmonious. But a discordant note is struck when the combination occurs in more highly organized society. In Havana, for example, one may read the following Sunday program: Mass at 8 a. m. Cock fight at 11 a. m. Bull fight at 3 p. m.

Before returning to Merida we were anxious to visit the interesting ruins of Tuloom, a short distance down the coast, now in possession of hostile Indians. It was only a few years ago that an Indian chief in possession of Tuloom had some dealing with the whites. This excited the indignation of his powerful neighbor, the chief of Chan Santa Cruz, who slaughtered the chief of Tuloom and all his family. Since this time there has been no communication with these Indians. Our venturesome friend Thompson wished to arrange a visit for us, but the waves were too high to permit of landing and we were obliged to content ourselves with a distant view from the sea. On the return we experienced another 'Norther' and saw more of state rooms than of the outside world.

The ancient ruins, which we were especially anxious to visit are not as yet very accessible to the traveller. It was arranged, therefore, that we should visit only Uxmal and Chichen-Itza, the two groups of greatest importance. Uxmal is some fifty miles south of Merida. We went as far as Tikul by rail and remained there for the night. As Uxmal is notoriously unhealthy we planned to go and return in the same day. This necessitated an early start, since we had before us a drive of twenty-five miles in a volan. He who has had only the ordinary experiences of mountain travel knows little of the possibilities of driving over rough roads until he has taken a volan drive in Yucatan. The whole country is one mass of limestone, upon which rests an extremely thin soil. Stones and masses of rocks constitute the roads and it is only by accident that one occasionally encounters a suggestion of smoothness. But a volan can traverse such roads and bring the passenger home alive. This extremely useful vehicle may be described as a two-wheeled litter or palanquin. The litter is swung upon heavy leather straps and is covered with an awning. The contents of the vehicle must be carefully balanced, hence the most comfortable attitude is to stretch oneself out at full length. The driving is frequently done at night, but sleep comes only to the experienced traveller, for one is tossed upwards and sideways and backwards and forwards with more rapidity and violence than in a small boat upon a stormy sea. The volan is drawn by three mules abreast, the central one somewhat heavier than the rest, supporting the shafts. The driver urges the mules forward by calling to them, "Mul-e, Mul-e, Mul-e," and cracking his hempen whip. The little mules are certainly wonderful animals for the purpose.

After a restless night in a hammock and a thorough shaking in a volan we reached the ruins of Uxmal and began the ascent to the Casa del Adivino (House of the Prophet). This building is elevated upon a pyramid about ninety feet high and the steep ascent up the narrow steps seemed full of peril. From the summit of this pyramid, however, one gains a general view of the ruins, or at least becomes acquainted with the relative position of the principal buildings. The impression from such a view is of a few massive structures buried in a woodland sea. Nor is this impression a mere semblance, for sea shells remain in abundance throughout the interior to tell us that the present expanse of trees is a comparatively recent substitute for the dark blue waves. In the immediate vicinity of the Adivino lies the irregular, rectangular court of the Monjas (Nunnery), a group of buildings of remarkable character. Nowhere else do we find in Yucatan finer architectural decoration. The ornamentation is largely geometric in character and exhibits a peculiar combination of symmetric with asymmetric design. It is difficult to explain this decoration as an evolution and one is tempted to think of foreign and especially Asiatic influences. Turning to the left we see prominently the house of the Governor and the less imposing structures called the House of the Turtles and the House of the Doves. The Governor's house is ornamented with imposing geometric sculptures and exhibits a series of recessed chambers with openings of finely curved arches. There are many other buildings belonging to this group, but we were obliged to leave without visiting them.

We lost no time on our return in starting for Chichen-Itza. The journey is somewhat long, involving four hours in the train to Izamal, then thirty-five by volan and fifteen on horseback. At Izamal we saw the remains of a pyramid whose faces contained elaborate sculptures

in stucco and another pyramid with strange tunnels inside. The Spanish church is an imposing building, and the huge *plaza*, which bustles with life during the annual fair, was now dull and empty. We were hospitably entertained by Dr. Gaumer, an American physician, who enjoys a wide reputation as an ornithologist. The rough volan journey and horseback ride being made in a night and a morning, we were too wearied to enjoy even a passing glimpse of the ruins and stretched ourselves upon the cots as soon as we reached Thompson's hacienda at Chichen. I fear that I shall incur our host's displeasure if I should speak of his hacienda as a ranch, since the Spanish *rancho* is applied only to properties of small extent. But what other American word shall I use to describe an estate of 23,000 acres, thickly wooded, with here and there a pasture or a cornfield or an orange grove, where the cattle gather at the front door and cowboys rest their wearied limbs along the porch? This *hacienda*, for we must so call it, was constructed some forty years ago, and deserted when hostile Indians made their triumphal march through the country destroying everything in their way. Otherwise it might still be in the possession of men who would care less than our friend for the magnificent ruins which it surrounds.

The ruins of Chichen are more numerous and cover a larger area than at Uxmal. And as these buildings represent only the permanent public buildings, we may imagine that the ancient town of Chichen-Itza was a city of no mean proportions. We take our general view from the pyramid of the Monjas. To the right is the lofty Castillo and to the left the Tennis Court with its adjoining temple. Nearer at hand are the remains of the Circular Tower and of the temple of Akab Tzib. There are many other structures in sight and still more so hidden by the woods as to escape our view. As we pass from building to building we see, as at Uxmal, evidences of the existence of a rich and powerful people, possessing a high degree of architectural skill. The same general principles of construction prevail and yet there are differences in our general impression. At Uxmal the technique is finer, the stones being more carefully shaped, and the decoration less profuse. At Chichen there is, however, a greater abundance of figured ornament and wall painting. Perhaps the most perfect and interesting building at Chichen is the temple adjoining the so-called Tennis Court. At the base of the pyramid there remains a room whose walls and ceiling were covered with sculptured figures arranged in horizontal bands. In part of the temple the serpent-head bases of the columns are in fine preservation, and in the interior the most perfect example of mural decoration that remains in Yucatan. It is much to be regretted that travellers, especially Mexicans, inscribe their names in charcoal over the walls and otherwise deface the paintings. We may, nevertheless, still discover large pictures of Maya chiefs or divinities, an interesting battle scene, representations of houses, ships, costumes and over the door, a representation of human sacrifice. Here the priest, as if a humane sentiment resisted his religious duty, approaches his victim backward. A survival of this blind religious zeal may perhaps be recognized in the intense devotion manifested by the Mestizos in their adherence to the Catholic faith. Interesting sculptures of a dwarf divinity are found in connection with another pyramid. A most artistic and original sculptural device is the use of serpents as balustrades to the steeply inclined stairways of the pyramids. The body of the snake is carried up the sides of the stairway, while the head stands out at the base as a kind of newel post. This motive

seems to have been widely spread, but is especially noteworthy at Chichen. When we shall have secured a thorough plan of all the ruins of this neighborhood, their extent and magnificence will certainly enlarge and deepen the impression to be derived from existing publications.

Before leaving Chichen we should not leave unmentioned the interesting *cenotes*, or natural wells, which here abound. The very name Chichen-Itza, the mouth of the sacred well, calls attention to the wonderful device of nature in affording a supply of water to a country, which for the winter months would otherwise be perfectly dry. Occasionally the *cenote* itself dries up, and in one of these Thompson has started a coffee plantation, with every prospect of success. In others the water is so clear and deep that one may follow for many seconds a stone as it forces its wriggling path to the bottom. In several cases the wells are as much as a hundred and fifty feet in diameter and fifty feet in depth. Long roots of overhanging trees and drooping shoots present a strangely picturesque appearance. In the season when the orchids are in bloom the *cenote* banks must be especially beautiful.

When we compare the buildings of East Yucatan with the monumental ruins of Uxmal and Chichen we find that similar conventions and modes of building prevailed throughout the country. In every group of ruins one or more buildings are elevated upon pyramids. These pyramids are very varied in character. Some are solid; others are honey-combed with rooms. Some are strictly pyramidal; others are stepped with platforms of regular or irregular form. Some have ornamented bases, others are plain. All of them have a temple or other building on top. Constructively, various methods of laying stone are employed, but the use of stretchers and headers and of laying the blocks with alternate joints seems not to have been reached even in the best buildings. As a consequence an external facing of stone sometimes peels away in large masses or a rent is made along the connecting joints. This is particularly likely to happen when the buildings are overgrown with trees. The natives have also freely used the ancient structures as quarries, carrying away the stone for fences and demolishing in their lime kilns the finest sculptured blocks. The Mexican government has declared the ruins to be national property, but beyond this has done little to preserve them from destruction.

The rooms in these stone buildings have vaulted ceilings. These vaults are constructed on the principle of the false arch, by superposed horizontal blocks and flat key-stones. In a few instances at Chichen the vaults are terminated by stones which lean against each other at a sharp angle, thus leaving a pointed ridge. Outside and inside the buildings were covered with stucco and painted. In some instances we counted seven or eight layers of stucco, indicating that the buildings had been thus renewed many times and usually painted with a new color. The cement used for the inner walls was of a fine quality, and served as the ground for paintings which have for the most part disappeared.

There is a strange device which is observable everywhere. Beams, many of which still remain, were placed across the vaults at various degrees of elevation. Sometimes these are explained as devices for the suspension of hammocks or other objects. But it seems more probable that they were intended as supports for the vault. The circular building at Chichen furnishes interesting confirmation of this. This building is an extraordinary structure the outermost tower enclosing a second, which in turn encloses a third. The spaces between each tower are vaulted

and these vaults are strengthened by a system of internal buttresses made of stone. Under ordinary circumstances the thick walls rendered internal stone supports unnecessary; wooden beams sufficed. These wooden beams in the stone building represent the same method of construction as is still practiced in ordinary thatched roofed houses. This resemblance between the architecture of the ancient ruins and of the wooden houses in Yucatan has an important negative bearing upon the question of origin. The evidence seems to show that the builders of these pyramids and temples did not derive their architectural traditions on the one hand from races like the Egyptians or Assyrians accustomed to stone or brick, nor on the other from refined constructors in wood, such as the elaborate carpenters of China and Japan.

The stone buildings are no more nor less than the work of semi-civilized American Indians, whose ancestors were accustomed to live in primitive rod and leaf houses, such as those inhabited by their descendants at the present day.

SUMMARY OF PAPER PUBLISHED.

ENGLAND'S BANKING LEGISLATION.

By W. M. DANIELS.

The approaching necessity of congressional legislation upon the subject of banking, renders a review of the English precedents of 1844 interesting as well as instructive. Peel's Act, passed in that year, remains to this day substantially the foundation of the currency system of England. The then approaching expiry of the charter of the Bank of England coupled with the wide spread discussion incident upon the commercial crises which had preceded, paved the way for drastic legislation in 1844. The man who shaped this demand for a reorganization of banking in England was Samuel Jones Lloyd, afterwards Lord Overstone, the founder of the so-called "Currency Principle". The essence of this principle is the direct relation posited between the volume of the circulating medium and the general scale of money prices. According to this theory, an increase in the circulation will depress the exchange value of each unit thereof, and will thus raise the general scale of prices. This theory is now recognized as very crude, inasmuch as it overlooks the rapidity of circulation and the expansion or contraction of credit, as well as various other factors which serve to condition and qualify the quantitative theory of money pure and simple. The Act of 1844, however, provided that the note circulation of the kingdom should no longer be determined in amount by the will of the issuing bankers, subject only to the condition of convertibility into gold on demand, but that the Bank of England should be allowed an uncovered issue of fixed amount against certain securities held by the Bank, mainly government bonds, and that thereafter every note issued should be backed by an equivalent amount of gold. The right of note issue was restricted to all then exercising it, and all other note-issuing banks were limited in the amount of their aggregate issue. It was the design of the measure ultimately to abolish the "country circulation", although this end has never been realized. The law in question also provided that any one by depositing gold with the Issue Department of the Bank of England might receive notes therefor. It is maintained that the law in question has not secured many ends it was designed to attain, as, for example, the abolition of commercial

crises; and that such ends as it did secure were purchased at too high a price. The drastic provision regulating note issue has aggravated panics when they have occurred, and has been set aside by force of circumstances on various occasions. Moreover the convertibility of circulating notes, it is submitted, is adequately guarded by the strict legal enforcement of convertibility on demand. The inference drawn from English experience is that too stiff an insistence on a bond security as the sole basis for our future bank-currency in the United States, will entail upon us inconveniences similar in nature to those experienced abroad.

[Summary of a paper entitled "A Lesson from England's Banking Legislation," published in the May number of the *Banker's Magazine.*]

SUMMARY OF PAPER READ.

SHOULD THERE BE A COURSE OF SIX YEARS IN LATIN IN OUR SECONDARY SCHOOLS?

By ANDREW F. WEST.

It may seem a deplorable fact that in the Secondary Schools of our country, public and private taken together, there are eight pupils in Latin to one in Greek.† That only fifteen to twenty thousand pupils should be studying Greek is of course a bad thing. It looks bad when we think how many more, both in absolute numbers as well as proportionally to the population, are studying Greek in England or France or Germany. It is bad in itself, as evincing how few there are who are devoting themselves to the study of all studies which fosters acute and noble thinking, the finest taste, the ideal literary temper and an unquenchable love of knowledge and truth. Yet for all this, though pupils in Greek are comparatively few and always have been few, and perhaps always will be few, they are, nevertheless, as a rule, pupils of exceptional promise when compared with the mass. They are the best part of the intellectual *élite* in our secondary schools. It makes little difference how this is accounted for, whether by the supposition that Greek produces fine effects on boys who are capable of these effects, or that boys of a certain kind take to Greek, or even by the idea that tradition is responsible for the prejudice in favor of Greek, and that other studies may produce as good results. The undeniable thing is that there is a fine effect secured wherever Greek is well taught, and to say other studies will do equally well does not destroy this great fact, for I need hardly argue in this presence that there is an affinity, amounting to the recognition of kinship, between a certain class of the finest minds and Greek. Still there ought to be many more boys learning Greek than there now are in this country, and so from this point of view it is a deplorable fact that there are eight in Latin to one in Greek.

However, it is not a deplorable fact that not far from a hundred and fifty thousand boys are now studying Latin in our secondary schools. It is a great number, though it ought to be greater,—and as the

† Such was the fact in 1891-92 according to the last Report of the United States Commissioner of Education (Vol II, pp. 695 and 698), and the proportions must be nearly the same now. According to this Report, the pupils in Latin in public secondary schools were 93,144, and in private secondary schools 38,892, making a total of 132,036. The pupils in Greek in public secondary schools amounted to 9,397 and in private secondary schools to 8,543, making a total of 15,940 These statistics are fully complete, lacking only a comparatively small number of schools and the pupils who study under private tutors. At the present time we may roughly estimate the pupils studying Latin as probably less than 150,000 and those studying Greek as clearly less than 20,000.

number becomes greater, the amount of time devoted to the study longer and the methods of instruction more rational, the more will our higher culture be helped in general and the more will attention be directed at the same time to the importance of Greek. For where is the Latin professor in this whole land who is not forced, the longer he reads Latin, to feel how much greater is Greek and how overwhelmingly in debt to Greek is all that he studies? He goes further. He sees that to know Latin in its integrity, without mutilation or cramping, some knowledge of Greek is indispensable—and consequently that in order to get better Latin, we shall always be needing Greek. And so, as was suggested a moment ago, the more Latin is studied, the more will the cause of Greek be helped, by the very necessities of Latin. The *Eadem utriusque est viae* of Quintilian is here true in a new sense, not in the sense of the real unity of their linguistic structure, nor yet in the sense that a man who knows Greek is supremely helped in Latin, but in the sense that the demand of Latin for its own integrity is a demand that can never be met without Greek. Accordingly we may approach the question of extending the Latin in our secondary schools to a six year course with the assurance at the outset that if such an extension is good for Latin, it is helpful to Greek as well, and presumably to other studies, notably the modern languages.

The questions to be answered in any discussion of this subject are two—first, Is the proposal sound? and second, Is it practicable? The first question divides into two parts, Is such an extension good for Latin itself? and Is it good for Latin in relation to its other studies? That the proposal is good for Latin itself seems very clear. Notice that at this point it is not the question as to whether we have time in our school programme or enough good teachers ready at hand or means to carry out the proposal. But the question in this form is, What time is needed for the proper study of Latin? and, Will the proposed extension substantially give the time, or at least so much of it that a great gain will be secured? Now Latin, like Greek, cannot produce its proper effect on the pupil without prolonged study. It may do him some good. It may be better for him to have learned and lost than never to have learned at all. We are not inquiring as to how little Latin a boy can get along with, but what amount of time he needs to understand it, if Latin is to produce its proper effect upon him. There is no need here to give the arguments which prove that the study of Latin needs a good deal of time. They are old and well known. They all rest on the fundamental fact that the pupil's study of Latin is an initiation into a regular and complicated, though never obscure, language and literature, which contain a combined discipline and culture admirable in itself and highly valuable, even indispensable, to a true appreciation of our own civilization. This priority of Latin to our modern life is no mere priority of time, like the priority of Chinese or Russian, nor is it a priority of time and incidentally modifying cause, like the priority of Arabic, nor is it a priority like that of Hebrew, which, however important its other relations, has no important relation to our language. It is a priority of determining cause. Without Latin our modern life would have been different, our own English tongue would have been different, and our relation to other modern languages greatly altered. It is because of its priority as a determining cause that its relation to us is permanently defined. Being permanently defined as an essential of any higher culture that aims at explaining our own civilization and language and being a study of considerable com-

plexity, calling for plenty of time on the part of the pupil, it is clear that if it is to be studied thoroughly it ought to begin early enough for the pupil to take full advantage of it in relation to other studies which lie around it in close relation, and, with this secured, as much earlier as the study of Latin needs for its completeness and as the development of the young pupil's mind will allow. Accordingly, the very nature of Latin as a subject of school study demands that it begin early and last a good while, if it is to have full opportunity to produce its best effects.

Now, have our American schools and colleges so arranged their programmes that Latin begins early enough, has enough time allotted to make it sufficiently substantial while it lasts, and lasts long enough? I might add, is it taught well enough? But this question is out of place here, for, as Professor Shorey well remarked at the Educational Congress in Chicago in 1893, "we must be consistently optimistic or pessimistic" in regard to this question of how studies are taught. An indictment of bad teaching is one thing, an indictment of the character of a study is an utterly different thing. The question whether Latin or any study is badly taught is of course a vital one. But it has no proper place in our discussion, unless it be a fact that Latin is so badly taught that it is exceptional in this respect. We need not waste much time over this point, for as a matter of fact, Latin is in no such predicament. Compared with the teaching of other studies it is surely not worse than the average. It cannot well be worse than some of the French and German teaching, or than some of the folly which is allowed to misrepresent the great name of science in certain courses in elementary physics and chemistry. And yet no one thinks of disturbing French and German or of making an indictment against the sciences because here and there they are badly taught.

Let us then return to our proper themes. Does Latin begin early enough? Has it time enough to be substantial while it lasts? And, does it last long enough?

The age for beginning Latin has been discussed from the psychological standpoint again and again, and, so far as I know, there is no general dissent from the position that the age of ten or eleven years is about as early as it is advisable to give boys their start. Of course there have been some who favor taking boys even younger than this. There are instances where such a very early start, say at eight or nine years of age, has produced remarkable results. But they are the rare instances, and cannot be made a basis for school programmes in general. In some of these cases, however, it is to be feared the very early start has been injurious, resulting in a precocious and superficial juvenile knowledge, which did not enter deeply into the subsequent manhood as an enlightening and informing element of character. It is sometimes forgotten that the Romans did not write books for children, but books for men. There are other cases where starting a boy very early in Latin has been a real injustice to him, producing a lifelong antipathy to the study. Deducting these genuine early cases, there is a spurious form of early study of Latin, which deserves just a passing word. We have all heard great tales of boys who swept the circle of college preparatory Latin before they arrived at their teens, veritable young Jack-the-Giant-Killers. Suppose they did. Does this show that they studied Latin at the best time for them or in the best way? When they finished their Latin studies, had they gained a ripe appreciation of them? Were they masters of Latin? Of course not, unless they were geniuses, and for geniuses we cannot legislate. But

some of these tales are mythical. They go with other tales calculated to impress upon us our degeneracy compared with the men of other days. Who has not seen some elderly person, reputed to have broken the ice in his pitcher every winter morning for years, to have sawed a cord of wood before breakfast, and to have performed generally and with ease other labors of Hercules? Of such were some of those who demolished Latin early and in the same way.

But there is a better way to discover when Latin ought to begin, and that is by an appeal to the best educated experience of the world. For this question is after all a question for experts to determine. In Prussia students enter the universities at an average age of a little under twenty years. They have just finished a gymnasial course of nine years, with Latin all the way through. Thus they begin Latin by the time they are eleven years old. In the French Lycées the beginning age is about the same, possibly a trifle earlier. Of the English schools it is harder to speak with precision, in the absence of a secondary programme which applies equally to the whole country. But it is safe to say that the boys in the great English Public Schools begin Latin fully as early as in Prussia. What is our situation? Let us hear in the words of the Report of the Latin Conference to the Committee of Ten on Secondary School Studies. * "In the United States the average age is about fifteen years, and probably above that number rather than below it." It is, of course, the judgment of this Report that we ought to begin Latin earlier, and that judgment is in accord with the best modern experience.

Still, taking Latin as we have it, is enough time now allowed it proportionally to the rest of the school programme, or, in other words, how many exercises a week ought Latin to have? In a Prussian gymnasium the average is about seven exercises a week. In a French Lycée it is slightly less, and the same is probably true of the English public schools. Of course it is to be remembered that both the French and Prussian schools have a greater total of exercises each week than is the case in our schools. But the Latin is at least one-fourth of the whole secondary school work. The Committee of Ten inclines to a school week containing twenty periods of class exercises, each exercise being forty to forty-five minutes in length. Five exercises a week in Latin during the time it is taught is accordingly one-fourth of our proposed school programme. In the four-year course suggested by the Committee of Ten as the classical course, and the four-year course styled the Latin-Scientific, the number of exercises a week assigned to Latin is five for the first two years and four for the last two. This comes so near to giving one-fourth of the time, that it may he accepted as almost a sufficient proportion of the school programme. Such an amount of time for four years represents nothing more than an advance on the practice of our poorer schools, an equivalent to the practice of our better schools, and an approach toward what is allowed in our best schools. However, if Latin were studied a long enough time, there would be nothing to quarrel over in a secondary programme which allots it one-fourth of the class exercises.

But, after all, one exercise a day in Latin for four school years, which is a trifle more than the Committe of Ten put in its programme, is insufficient. One-fourth of the school time while Latin is being taught is of course all Latin ought to have, but five exercises a week for four years is only about one-third of the actual time given to Latin in the Prussian

* Report of the Committee of Ten, Page 60.

gymnasium. The showing is somewhat better if we consider not the actual time given in the Prussian gymnasium, but the proportion allotted to Latin in comparison with the rest of the gymnasial programme. It then becomes a question between one-fourth of our secondary school-work for four years and one-fourth of the gymnasial work for nine years,—but even in this the showing is more than two to one against us. Of course we must not leave out the two years of prescribed Latin found in many of our colleges, and amounting at most to one-fourth of the Freshman and Sophomore years. Adding this in, the best showing we can make is one-fourth of six years' work given to Latin as opposed to one-fourth of nine years' work given in Prussia. And the showing we could make in comparison with the French and English schools would be but little more to our advantage. Clearly the trouble is not with the proportion of time given to Latin while it is studied, but with the number of years devoted to it. Some may think the remedy is to be found in requiring more Latin in college, and thus supplementing the deficient school work. Suppose this were done, and we were to add two years of prescribed Latin to the two years now prescribed in many colleges. The average age of graduation in our principal colleges is at least twenty-two years. With four years of college Latin preceded by four years of school Latin the American boy would still begin to study Latin as late as he now begins it, and no remedy would be found for this evil. Furthermore, another evil would be created. College students are older than they were a generation ago. They cannot be kept in leading-strings forever. When a young man becomes of age he ought to be far enough advanced to be out of his secondary studies, and if he pursues Latin at that age, it ought not to be to learn how to read it, but to take it as a real university study, in which case he ought to be free to choose it or leave it. It is not best to keep giving young men the studies they ought to have had when they were boys. Furthermore, we cannot spare the time in the upper years of American colleges and universities, and the increasing age of students is the reason why the time cannot be spared. They must get to their life work, and if we do not arrange so that they can get to their life work reasonably early they will break away from college studies. But even if they would stay and stand a dose of four years prescribed college Latin on top of four years prescribed school Latin, it would not be wise to have it so, because if Latin is not begun early the full benefits of the study are not secured, and if begun early it does not need to be prescribed up to the end of the college course.

So far, then, as the interests of Latin itself are concerned, it is clear that while the proportion of school time allotted Latin while it lasts is fairly satisfactory, Latin does not begin early enough nor does it last long enough, and it would be a good thing for Latin to make it begin at least two years earlier than it now does. In this way an American boy starting his Latin at twelve years of age in the upper classes of the grammar school, and pursuing it for four years longer in the high school, would not need to continue it a day longer in college than he now does, and would be far better educated than he now is.

But is the proposal good for Latin in relation to other studies? The answer is almost inevitable that it is. It is natural to suppose that if any great central study is adjusted rationally so far as concerns its own advantage, the effect of this will be good on everything else which in any way depends upon that study. We may take this as an axiom. Let us glance at

the subjects with which Latin is closely related. Greek is one of these and need not be discussed here, for the benefit is only too obvious. Take the case of our own language. Great as English is, it is not great grammatically, whereas the boy who is beginning Latin is not so much studying a special grammar as grammar in general. He is gaining the grammatical instinct as such, and the earlier he gets this the better. And where will the most of our boys in secondary schools get it better than in Latin? Some may say in Greek. But this need not be argued, inasmuch as only a small number will study Greek compared with those who will study Latin. Nor will the grammars of French and German stand him in such good stead as will the Latin grammar, mainly because these languages and grammars are coördinate with English, whereas the relation of Latin to the modern grammars is a radical one. They do not explain Latin grammar, but Latin grammar is constantly doing a great deal to explain them. And so, not only in English but in modern languages, the earlier study of Latin is an immediate help. Any good teacher can point to many an instance where this has proved true, even down to the accuracy of English spelling. How many of our best educated men have never needed a full grammatical training in English simply because of their Latin grammar? This early study of Latin is good for other things besides our own and foreign modern languages. It is a good thing for the boy in his relation to scientific study. It is admitted that some scientific study should come early. It is also becoming more and more the opinion that the observational side of science should come early, and that the analytical part of science should follow the observational. It is clear that if the time in the school programme permits room for Latin and the elements of the observational sciences, the boy is helped in his boyish study of science by the increased ability he gains from his elementary Latin. This results from the definiteness and regularity of the Latin language, which fosters the pupil's power of accurate discrimination in his thinking, and at the same time of accuracy in his expression. Even at this early stage he receives real, though only incidental help from the number of Latin words which enter into scientific names, particularly in botany. But there is a more important side than this. The real serious study of science is not a schoolboy study. The severe consecutive analytical thinking involved in dealing with the great problems of nature can scarcely be attempted before the pupil attains some maturity. However valuable the elementary school courses in physics and chemistry may be for those who cannot go on to college and university studies, and take them up when they are old enough to do them substantial justice, it is a fair question whether school courses in these subjects are not injurious to those who are to pursue them more fully at a later stage. But whatever our opinion on this point, it can surely do no harm to physics and chemistry and astronomy and mechanics if the college student comes to them with a fine preparation in Latin instead of a poor one. The report of the Latin Conference to the Committee of Ten well characterizes Latin as "an instrument for training the mind to habits of intellectual conscientiousness, patience, discrimination, accuracy and thoroughness—in a word, to habits of clear and sound thinking."§ But habits of clear and sound thinking are just what are demanded in all scientific study. Accordingly for all who take up the serious study of science in college, a better preparation in Latin is a great help. We need not give further exam-

§ Report of the Committee of Ten, Page 62.

ples, for the benefits of a good Latin training in the whole circle of college studies is not seriously questioned. Since, then, we are helped in the school studies, and also helped in the college studies, without any sacrifice of time on the part of other college studies to make way for Latin, we may conclude that the establishment of a six-year course in Latin instead of a four-year course as at present, would be beneficial to Latin and to other studies.

II. Our second main question remains to be answered. Is the proposal for a course of six years in Latin in our secondary schools practicable? If this question means, Can a six-year course be instituted generally in our secondary schools immediately? the answer must be a negative one. Even if we could establish to-morrow all over the United States a six-year Latin course, it would not be desirable to do it. In no civilized country in the world is the individuality of secondary schools more marked than in this country. In this respect we bear a considerable though not a close resemblance to England, and are very different from France and Germany. In France and Germany the secondary course is embraced in one school, and is often so in England. But with us the secondary teaching is divided between the college and the school. One of our great troubles to-day is the lack of close articulation between the last teaching of the secondary schools and the first teaching of the college. The upper limit of the school and the lower limit of the college do not evenly coincide, and consequently it is difficult to treat our secondary education as a unit. Furthermore the secondary schools themselves are of various kinds. We have the endowed academy and the unendowed academy, the city high school, the preparatory departments of colleges, and the endless variety of private schools. The task of getting all these secondary schools to act on one plan for any one end is a very difficult one. Then, too, we have no such tests for the qualification of teachers as we ought to have. Teaching in the secondary schools will become a profession, in the same sense in which law and medicine are professions, when we exact both a liberal and a professional culture from all who aspire to teach and recognize the dignity of the teaching profession by paying respectable salaries. We have not yet done this. But in spite of all our drawbacks I believe we are slowly moving in the right direction so far as concerns the Latin question. How can the Latin course be lengthened? In the case of academies having a four-year course it will gradually become practicable to add an extra lower year at first, and subsequently a second lower year, thus making the six years asked for. A similar arrangement will work in connection with the stronger unendowed private schools of the country. In regard to the high schools the case is somewhat different. Four years has by common consent come to be the length of the high school course. I am not well enough informed to say whether it is possible to make a six-year high school course. In cities where the grammar school course is followed by what is known as the intermediate school course of four years, it may be possible to split the intermediate course in two, giving the upper two years to the high school and the lower two years to the grammar school. But such is the tenacity of custom that it seems doubtful whether the high school course for some time to come will be more than a four-year course. Still it hardly admits of question that if we can have a six-year high school course it will be a great help to our whole secondary education. The other solution is to begin Latin in the grammar school two years before entering the high school, and this would of course secure six years

of Latin, though it would not secure it so well as to have the whole six years organized in one school.

An objection is sometimes brought against beginning Latin two years earlier, to the effect that it would require the displacement or diminution of some other study or studies. Now it is not proposed to compel anybody to learn Latin, but only to see that those who do study Latin have a proper amount of time to get the best education in that study. No one will be compelled to take a six-year Latin course any more than he is compelled to take a four-year Latin course at the present time. No one will be compelled to stay in a six-year Latin course any more than he is compelled to stay in a four-year Latin course. But those who take up the study are guaranteed enough time to pursue it with thoroughness. No doubt, for those who study Latin, time will be taken from some other things, but the whole time proposed to be taken amounts, after all, to only one-half of one school year. The gain to Latin is very great. It is greater than the time taken represents. For the study of Latin has two stages, the first stage of discipline and the second stage of culture. The stage of discipline, while it can be made pleasant, is by no means so enjoyable as the later stage of culture, where the student experiences the deep enjoyment that comes from being able to read and appreciate great masterpieces. Now the time that will be added will go mainly, perhaps almost entirely, to the second stage of the pupil's development, and this, I need hardly say, is a gain far greater than the time taken to secure it represents. We are not proposing two years more of Latin grammar, but that Latin grammar begin two years earlier and that we give two years more of Latin literature. Hence the great gain in Latin is a fair offset for those who study Latin against the loss they may suffer in some other things. But what are the other things? What is it they will lose? The misery of English grammar, I hope, for one thing. The endless "doing of sums" for another thing, and the reading in reading books which have so little literature in them. But will arithmetic and English grammar and English literature suffer by this? By no means. For the Latin will be both tonic and cathartic in relation to other studies. Will injure the learning of the modern languages? Will not the extra time given to Latin be more than made up by the speed and strength of the pupil's progress in French and German? It is a matter of common admission that the greatest waste of our school time is just below the secondary schools, and it is in this place that the introduction of Latin for those who mean to study Latin will do great good. Suppose, then, we can add two years of Latin gradually to our secondary work. With six years of Latin in school and two in many of our colleges, we shall then have eight years of Latin occupying one-fourth of the pupil's school time, without injuring any other study, without prolonging Latin too late as a prescribed study in the student's life, and for the first time in our history we shall be in a way to put the study on a basis where it will bear comparison with the best Latin education of the world.

[Address delivered before the Classical Conference at Ann Arbor, Michigan, March 27th, 1895.]

REVIEWS OF BOOKS.

MENTAL DEVELOPMENT IN THE CHILD AND THE RACE. METHODS AND PROCESSES. By James Mark Baldwin, Ph.D., Professor in Princeton University; pp. XVI, 496. New York and London. Macmillan & Co. 1895.

The main purpose of the author in this volume is to lay the foundations of Genetic Psychology in the systematic observation and study of the consciousness of the developing human infant, and also to correlate the ontogenetic problem of individual development with the wider phylogenetic problem of the mental evolution of the race. In pursuance of this aim, Professor Baldwin, in his first chapter on Infant and Race Psychology, takes the ground that the only adequate phenomena for genetic psyehology are to be found in the infant consciousness. The child is father to the man, and the observation of the facts of its growing life not only reveals the synthetic processes of natural development in their simplicity, but also supplies indispensable data for the analysis of the complexes of the adult consciousness back into their simple elements. Moreover, the individual history must be correlated with that of the race, and this leads to a critical examination of Recapitulation, the theory that the biological race history repeats itself in the stages of individual experience. The author maintains that this is not true without modification, and points out in this connection how, by means of the principle of "lapsed links," which is explained in a later chapter, the individual, especially when consciousness has become a factor in its development, may abbreviate in various ways the race processes.

The next four chapters are devoted to an exposition of the author's New Method of Child Study, and its application to Distanee and Color Pereeption, the Origin of Right-handedness, and Infant Movements involved in child's drawings and the Rise of Tracery Imitations.

In chapter VI, on Suggestion, the author enters upon the development of the main lines of his theory. Suggestion, which is defined as "the tendency of a sensory or ideal state to be followed by a motor state," must be recognized to be as fundamentally a kind of motor stimulation, the author asserts, as the direct excitation of a sense organ. Suggestion must be regarded as a primary conscious function, while the power of a sensory or ideal state to arouse motor responses depends on the mechanism of another simple mental function, namely, Attention, which is treated in a later chapter, and through which three results are obtained: (1) the concentration of consciousness upon the suggested idea; (2) the consequent narrowing of motor impulses to simpler lines; (3) the consequent inhibition of the discriminating and selective attitude which constitutes belief in reality. By this means ideas become free to exercise their normal suggestive power. Several species of suggestion, including Physiological, Sensori-motor, Ideomotor, which involves Imitation, a function that comes up for elaborate treatment in later chapters, Inhibitory and Hypnotic, are then passed in review, and the chapter closes with a statement of the Law of Dynamogenesis or Suggestion on its motor side; namely, that action always tends to follow the suggestion-stimulus.

When, however, we ask what kind of an action follows we have, the author says, two possibilities. A habit may follow, or an accommodation, which means the breaking up of an old habit, may follow. The questions which is it and why is it one rather than the other leads to the topic of the next chapter, The Theory of Development. In his theory of development, Professor Baldwin is a modified Darwinian

so far as his view which contains many new features is classifiable. The law of Dynamogenesis is fundamental, but it eventuates in the two laws, Habit and Accommodation. Now in so far as the result is habit the movements follow beaten tracks and there is no special difficulty. But there is also no development. The special problems arise in connection with Accommodation which means adaptation over and above habit and, therefore, selection. The great problem of Development then is that of selection. The author at this point makes an important modification of the Darwinian theory of selection among random movements or variations, of those which tend to survival, by maintaining that the selection is not among movements at all but rather among stimulations. It is the stimulation, not movement, that the organism is after. This enables him to reduce the sphere of accident by locating the motive of the adaptive movement within the organism. The organism seeks a repetition of those stimulations which tend to expand and heighten the life processes and avoids those which tend to contract and diminish them. Thus we have what is called organic selection, which takes the form of "the functional adjustment of the life processes to variations in its own motor responses so that beneficial relations are selected from the entire mass of responses." This process is the neurological analogue of the hedonic consciousness, and the author's position is that "the life history of organisms involves from the start the presence of the organic analogue of the hedonic consciousness." Now the hedonic consciousness is simply the consciousness of pleasure and pain and teleologically, therefore, the whole range of motor accommodations is motived by the original tendency of the organism to get pleasure stimulations and to avoid those of pain.

Keeping in mind, then, the heightened life process which as the analogue of the hedonic consciousness may be taken as expressing the organic aim of development, we may ask, how is this aim realized? It is easy to answer, by habit and accommodation; but these are the very things which need explanation. How does the organism conserve the old movements and at the same time reach forward to new adaptations? In answering this question Professor Baldwin develops two of the distinctive features of his theory. The first is that circular process by which the organism is able to repeat over and over again a stimulation which it has selected, and the second is the law of Excess or over-production which may be regarded as a heightened nervous energy brought about by the pleasurable stimulation. This heightened energy leads to an excess or overflow of movement over the old channels and to further adaptations of which the pleasurable ones are selected and repeated.

Combining the circular process by which an old stimulus is reinstated with this law of excess by virtue of which the reinstatement through its pleasurable characteristics and concomitants tends to increase the movements and leads to new adaptations, and applying to the whole the term *Imitation* we reach what Professor Baldwin regards as the most fundamental category of mental development. Imitation is a name used for that circular process by which the organism not only repeats the habitual movements which are adapted to produce old stimulations but also through the law of Excess transcends this beaten track and leads on to new results. Imitation thus constitutes a synthesis of both habit and accommodation while at its root lies that principle of Dynamogenesis which is more fundamental than either.

If we add to this the fact emphasized by the author, that in the mental sphere Consciousness is nature's great accommo-

dating agent and that Attention is the great accommodating agent of Consciousness we will be prepared to follow the theory of development whose outlines have been given, into the details of its application. Not to dwell on the very suggestive chapter on Motor Attitudes and Expressions, the remainder of this notice will have to be confined to a very brief statement of the author's application of the principle of Imitation. Assuming Imitation, as already explained, to be the one fundamental category of mental growth, and Attention to be its prime selective agent, Professor Baldwin, under the heads of Organic and Conscious Imitation, proceeds to determine, first the physical basis of Memory and Association and then in detail to point out the conditions of the rise of the various mental functions, Memory, Imagination, Thought, Emotion and Volition. To Volition a separate chapter is devoted and it is traced to its genetic source in the function of persistent imitation in which we have "the necessary elements of the voluntary Psychosis for the first time clearly present." The book concludes with chapters on The Mechanism of Revival, The Origin of Attention, and a final statement of Habit and Accommodation. There are also two Appendices the second of which is supplied by Mr. Lester Jones, Fellow in Mental Science.

The following are some points of special interest and value in Professor Baldwin's work. (1) The new method of child study and its correlation with the problems and laws of race development, (2) the criticism of Recapitulation and the statement of the principle of lapsed links, (3) the important modifications proposed to Natural Selection in the principle of Organic Selection and the law of Excess, (4) the whole treatment of Imitation in its definition and application as a fundamental category of mental development, (5) the primacy which is claimed for psychological over biological categories. To supplement this work on Methods and processes another volume of interpretations is promised.

ALEXANDER T. ORMOND.

COLOMBA, par Prosper Mérimée. Edited, with Introduction, Notes and Bibliography, by A. Guyot Cameron, Ph.D., Assistant Professor of French in the Sheffield Scientific School of Yale University. New York, Henry Holt & Co. Pp. xxiv and 216.

Students, as well as teachers, of the French language are peculiarly fortunate in that there are available for their class use so many excellent short stories by writers of acknowledged eminence; and the educational world is to be congratulated that the enterprise of our publishers is so rapidly increasing the list of good editions of them especially prepared to meet the wants of American schools and colleges.

The little book before us is a good illustration of what we mean. Mérimée's place in French literature is second to none among the prose writers of the nineteenth century. And his short stories are, with the possible exception of a very few of Balzac's and Gautier's, beyond comparison with anything else in their kind. The longest of these stories, and in some respects the best, is the one which Professor Cameron has edited in this volume. The scene of its action is of especial interest at this time of Napoleonic revival, and the little island which gave birth to the great conqueror is here so vividly described that, as Sainte Beuve puts it, "if you wish to know Corsica, you are spared the trouble of a trip to it; you have *Colomba*." For Colomba is the very epitome of Corsican characteristics and Corsican scenery: its feuds, its fierce love of independence, its stern regard for justice, its thirst for vengeance, and its songs of hatred,—set off against the background of its mountains, its flowery

plains, and its rock-bound coast, washed by the waters of the blue Mediterranean.

To this almost savage fierceness of its subject and scenery the style of Colomba stands in striking contrast. In the most vehement expressions of out-pouring passion, the style preserves that classic firmness and delicacy of touch which everywhere characterize its author, and throughout the work we recognize Mérimée's exquisite literary workmanship.

The text of the story is prefaced in this edition, by an appreciative sketch of Mérimée's life and character, and a critical estimate of his literary work. The introduction also contains a somewhat elaborate bibliography of Mérimée, which is the most complete that has yet been compiled in tabular form, and is very interesting as an indication of the wide range of the author's activity. The notes are mainly explanatory, and their most obvious feature of originality in treatment is the unusual fulness of their etymological discussions.

W. H.

HISTORICAL REVIEW.

The publication of an American Historical Review has for some time past been in the minds of several writers and teachers of history. The impulse found expression in a largely attended gathering held at the Reform Club of New York, on Saturday, April 6, in consequence of a call issued by professors of history in six of the leading universities. After long conference and thorough discussion, it was decided to organize an executive committee to take charge of the measures devised for the initiation of such an enterprise. This committee was likewise to edit the review for the first year, and be responsible to all contributors for the necessary guarantee fund, estimated at $2,000 a year for three years. Those chosen as members were Professors Adams of Yale, Hart of Harvard, McMaster of Pennsylvania, Sloane of Princeton and Stephens of Cornell. A sixth member, representing the West, is to be chosen. This editorial board has held its first meeting. The publication is to be quarterly, its title *The American Historical Review*, and its scope is the entire field of history, including articles on contemporaneous events and institutions, if written from the historical standpoint. Besides the body articles, there will be published book reviews written by competent experts, hitherto unpublished documents, domestic and foreign, and a substantial quantity of news as to the current work of writing, investigating and teaching in the sphere of history. The assured coöperation, not only of the leading universities, but also of the most distinguished American historians, will enable the editors to publish an important journal of the highest class. Great interest has been shown by the leading publishers, and substantial contributions to the guarantee fund have been secured, but the most liberal support is required from all interested, either as guarantors or subscribers. It is hoped that the friends of Princeton will be among the most liberal supporters of the enterprise, and Professor Sloane will gladly give any information desired. The second meeting of the editorial board was held on May 4. Professor Judson of Chicago University was chosen as the sixth member of the editorial board and Professor Jamison of Brown University was elected managing editor. The first number of the *Review* will be published in October. It will bear the imprint of the Macmillans.

SKETCHES OF THE NEW JERSEY HISTORICAL SOCIETY.

Under this title Mr. Alonzo Church, of the class of 1892, has gathered some interesting papers on the manuscripts, the books and pamphlets, the newspapers, and the art works and curios to be found in the valuable collections of the New Jersey Historical Society. To these he adds a brief sketch of the beginnings of Newark, the home of the Society. The object of these papers is to call attention to the useful work and unique treasures of a Society which the people of the State have too much neglected. It was eminently appropriate that a Princeton man should set himself such a task, for the connection of Princeton graduates with the work of the Society is noticeable at every turn of these sketches; the collections of the Society of course abound with memorials of men whose fame is associated with hers; and the close union between the history of the State and the history of her college is accentuated throughout the record. This interesting pamphlet ought to serve a very useful purpose in calling attention to one of the most scholarly and useful institutions of the commonwealth. W. W.

BRIDGE OVER THE LAHN AT NASSAU.

Princeton College Bulletin.

EDITED BY THE PRESIDENT AND MEMBERS OF THE FACULTY.

Vol. VII. November, 1895. No. 4.

NASSAU AND THE ORANGE AND THE BLUE.

By ALLAN MARQUAND.

In the *Princetonian* of May 21, 1895, Professor Libbey gives a bit of history concerning our College colors which cannot but interest us all. Orange, he ascertains, was first suggested by George K. Ward, of the class of '69, in the early part of his college course. Other colleges had already adopted distinctive colors, and Princeton as yet had none. The happy thought occurred to young Ward that as William of Nassau was also Prince of Orange, the Nassau Base Ball Club might well select the color orange. This color, accordingly, appeared as early as May 4, 1867, in connection with an invitation to a Yale-Princeton base ball game. In the autumn of 1868 all the classes adopted orange as the College color. The combination orange and black, Professor Libbey tells us, was first worn as our College insignia by the Princeton crews who rowed in the Intercollegiate races at Saratoga in July, in 1874, in consequence of his having brought from abroad (Oxford) ribbon of this character, sold to him as the colors of the Duke of Nassau. From that day to this orange and black have been our colors, at least in all undergraduate ceremonials. The official seal of the College upon the diplomas of Bachelors and Masters of Arts is affixed upon white paper to a ribbon which is orange only.

The name Nassau is one which should be dear to every Princeton heart, and which we would honor the more highly were its historical significance more deeply impressed on our minds. Let us hope that one of our historical scholars may apply himself to the study of the noble House of Nassau in its original stronghold in Germany, and to the investigation of its contributions to the cause of religious freedom and Protestantism in Holland under William the Silent and in England under William III.

It was an appreciation of the historical significance of the name Nassau that led to its being connected with our oldest

building, the building which once sheltered the entire College. The circumstance which brought the name to us is well known to all, but that it may be clearer in our minds, let me quote the record of it in President Maclean's History of the College of New Jersey, Vol. I, p. 146:—

"At the time of its erection this College building was the largest edifice of its kind in the British Provinces of North America, and in view of the very important services rendered to the College by Governor Belcher, the Trustees, in a very flattering letter addressed to the Governor, requested his permission to call this building 'Belcher Hall.'

"With a rare modesty he declined the honor, and at the same time expressed an earnest desire that the building should be called 'Nassau Hall,' in honor of King William *the third*, 'who was a branch of the illustrious House of Nassau.' It was therefore decided, by a vote of the Trustees, 'that the said edifice be, in all time to come, called and known by the name of Nassau Hall.'"

In common with many Princetonians I had assumed that orange and black constituted the colors of the House of Nassau. This misconception I carried with me across the Atlantic, when one day in conversation with the well-known artist, Alma Tadema, I observed that he wore upon his coat a bit of orange and blue ribbon. Struck by the resemblance to our College colors, I asked: "What is the significance of your badge?" To which he replied: "These are the colors of the Order of the Lion of the House of Nassau." But I answered: "The colors of the House of Nassau are orange and black." "No," he replied with emphasis, "they are orange and blue." This rather staggered me, but evidence soon began to accumulate that he was right and I was wrong. Finding that the combination was more beautiful than ours, and having this conviction fortified by a similar taste on the part of good judges of color, I bought some orange and blue ribbon of harmonious shades and determined to favor a change toward the more historically accurate and æsthetically satisfactory combination. No sooner had I returned to Princeton than I was confronted with Professor Libbey's orange and black ribbon, which I understood him to say he had received at first-hand from the Duke of Nassau, though I learned afterwards that this was a misunderstanding on my part. So I laid aside my orange and blue ribbon, waiting for further enlightenment on the problem.

Two years ago evidence began to multiply in favor of the combination of orange or gold and blue. I found first that these were the colors of Holland. Later I went some distance out of my way to visit the town of Nassau. Here, in the old castle on the hill, orange and blue window glass still remains in some of the windows, and in the town an orange and blue flag is the local emblem. I purchased such a flag in the town, and later a copy of the Nassau coat of arms—a golden lion rampant upon a blue ground billeted with gold. (See Frontispiece). Mr. M. Taylor Pyne had this copied in wood and placed as a sign-board at the entrance to the grounds of the Princeton Inn, where every visitor to Princeton may see it. I then secured several books on Nassau heraldry. The most important of them is Goeckingk's *Geschichte des Nassauschen Wappens.* This work contains colored facsimiles of the arms of the Counts of Nassau of the Otto branch, that of the Duke of Nassau and of the King of the Netherlands, besides many others uncolored, but with indications for the colors, including the arms of William III of England. Throughout, the Nassau arms appear as the golden lion on the blue ground. Other books of heraldry give the same result. It is enough here to cite the English standard work, Burke's *General Armory.* Under the title *Nassau* (Prince of Orange) we find: "*Az.* billetée, a lion ramp. *or* Crest out of a Ducal coro-

net *or*, the attires of a buck *gu.*" Here, of course, *Azure* stands for blue, *or*, gold and *gules*, red. In Burke's *General Armory*, under William III and Mary II, we find: "Arms, etc., those of James I with an escutcheon of pretence, thereon the arms of Nassau, viz., *Az.* billety *or*, a lion ramp. *gold.* Motto: *Je mainteindra.*" I have here followed Burke's spelling of the motto.

Having ascertained the Nassau arms, it may not be uninteresting to learn a little of its history. I select, therefore, and translate a few passages from Goeckingk. On p. 1 he says:—

"The two oldest Nassau seals in the Royal State Archives at Idstein, dating respectively from 1198 and 1220, show as the arms of this family a lion without further accompaniment. The first seal belonged to the Count Walram von Laurenburg, the other (a *Gemeinschafts-Siegel*) belonged to his two sons, Heinrich and Robert. In 1246, however, Heinrich employed a lion, accompanied by billets, which henceforth remained a characteristic mark in the arms of the Counts of Nassau. The arms of the Counts of Nassau, therefore, since the middle of the XIII century, has been a golden lion on a blue billeted ground."

Throughout the XIV, XV and XVI centuries the various branches of the Nassau family had variously modified the coat of arms. Accordingly, toward the end of the last century, a strong desire was felt by the now more closely united house of Nassau for a standard coat of arms. At a conference called for this and other purposes at Ems, and lasting from July 7th to August 2d, 1783, it was decided (Goeckingk, p. 4) that the standard arms should be

"A golden lion rampant, turned to the (*i. e.* his) right, wearing a red crown, with a red extended tongue and red claws, with upward swinging tail, upon a blue ground upon which are scattered seven golden billets."

The crown is supposed to have entered through the Emperor Adolph of Germany or King William of England. Should the emblem be utilized in any way by Princeton University we might well revert to the earlier crownless type.

There is a sentiment in the motto *Je maintiendrai* to which we might do well to pay some attention. The motto seems to have arisen in 1530–1544, when René became heir to the property of his uncle, Philibert of Châlon–Orange, upon condition that he assume his uncle's name and arms. He did so, adding the device *Je maintiendrai Châlon.* His heir, William the Silent, modified the device to *Je maintiendrai Nassau*, and his sons generalized it still further to *Je maintiendrai.* Should this device for any purpose be adopted by us it would suggest that we were loyal to, maintained and supported all that was worthy of being remembered in the illustrious House of Nassau and in its namesake Nassau Hall.

The practical outcome of this brief inquiry is that by virtue of one of the earliest and most lasting traditions Princeton University might well adopt as one of its emblems the arms of the House of Nassau, fraught as it is with significance with which we stand in natural and historic sympathy. Whether it be advisable for us to relinquish or not the orange and the black, which for twenty years have been the colors under which we have fought our battles and which have become so closely associated with our celebrations and our songs, is a question upon which it would be well to secure the sentiment of students, graduates, faculty and trustees. I am well aware that a change like this that to-day [illegible]nes general sentiment will be regarded by many as a departure from our past traditions, but the considerations which have been advanced in the earlier portions of this paper will show that in this matter we have been cherishing a mistake for twenty years, which the adoption of the new combination as our

University colors would serve to rectify. It would also connect us with a tradition which is now nearly seven centuries old, and thus serve to bring us into closer union with many noble and historic principles, the force of which upon us might not so easily be maintained.

We might easily go a step further in finding historic associations for the blue in preference to the black. This was the color of the Scotch Covenanters, adopted by them in accordance with the command given to Moses (Num. XV, 38 39):—

"Speak unto the children of Israel, and bid them that they make their fringes in the borders of their garments, throughout their generations, and that they put upon the fringe of the borders a ribband of blue: and it shall be unto you for a fringe, that ye may look upon it, and remember all the commandments of the Lord, and do them."

Blue is still the color which designates the most rigid of Presbyterians. No Princetonian would for a moment think of exchanging the orange for any other color. We can all sing with Mrs. Amelia E. Barr (in The Bow of Orange Ribbon):

"Tie the splendid orange,
Orange still above!
O orange boven,
Orange still above."

And shall we now hesitate to sing her other song?:—

"Oh for the blue and the orange,
Oh for the orange and the blue!
Orange for men that are free men,
Blue for men that are true.
Over the red of the tyrant,
Bloody and cruel in hue,
Fling out the banner of orange,
With pennant and border of blue.
Orange for men that are free men,
Blue for men that are true."

In the copy of this book in our College Library some one has erased the word "blue" and substituted the word "black." Imagine, if you can, the delicate color sense of the man who could sing: Oh for the black!

NOTE I.—Since this paper was sent to the press my attention has been called to the color indications upon our College seal. The entire upper half of the background is striated with horizontal lines, the conventional heraldic symbol for *blue;* the lower quarter to the right shows a net work of little dots, the recognized symbol for *gold;* while that to the left is lined diagonally in the direction which signifies *purple.* Having some doubt as to whether the original die were still in use, I repaired to the College Offices, where the seal is kept. I was struck by the fact that the die which stamps the impression emanates from the mouth of a *lion*, a fact which may have no significance, since I saw at once that the present instrument was not the product of the last century, but comparatively modern. So having secured a recent College diploma which contained a good impression of the seal now in use, I proceeded to compare it with more ancient impressions. Attached to the Bachelor of Arts diploma of William B. Maclean, '21, there is an excellent impression of the old seal. As compared with recent diplomas, it is evident that a different stamping instrument was then employed. The differences, however, are so slight as to be detected only on careful examination. They are such as these: The old seal was slightly, but measurably smaller; it had on its border two instead of three concentric circles; the lettering was more archaic and the shape of the diploma and its ribbon in the lower quarter to the left were slightly different and presented the motto *Meriti Premium*, instead of the *Premium Merit* of the present seal. There is also a difference in the inscriptions on the open Bible. The old seal was inscribed VET NOV TESTAME MAT. The new seal is inscribed VET NOV TESTAMENTUM. But the general design and the

color indications on both seals are the same.

We may go still further back. In the College Library there hangs the diploma of James Madison, signed by President Witherspoon and others, in 1771. This diploma bears the impression of a seal of the same size, lettering, etc., as those on the diploma of William B. Maclean. This old seal I find was used as late as 1865, and perhaps a few years later. By 1871 the College diplomas bear the impress of the new seal.

A perusal of the early pages of Dr. Maclean's History of the College will throw some light upon the origin and significance of this seal. The second charter of the College, given by George II, makes specific grant of the power to use a seal in the following language:—

"And further, of our especial grace, certain knowledge and mere motion, we do, by these presents, for us, our heirs and successors, give and grant unto the said Trustees of the College of New Jersey and to their successors, that they and their successors shall have a common seal, under which they may pass all diplomas, certificates of degrees, and all other affairs and business of and concerning the said corporation, or of and concerning the said College of New Jersey, which shall be engraven in such form and with such inscription as shall be devised by the said Trustees of the said College, or the major part of any *thirteen* of them, convened for the service of the said College as above directed."

The College was not slow to avail itself of this privilege. The charter was dated September 14, 1748. One month later, October 13, 1748, the Trustees voted "that the seal prepared by Mr. P. Smith (one of the Trustees) be accepted as the common seal of this corporation, and that the thanks of the corporation be returned to Mr. Smith for his care in deciding the same."

A description of the seal appeared in *Parker's Gazette and Post Boy*, March 21, 1748, in an account of the first commencement of the College, November 9, 1748, prepared by William Smith, one of the Trustees. It is as follows:—

"In the upper part of the Circle, a Bible spread open, with Latin Characters inscribed on the Left Side, signifying the *Old Testament*, and on the right side the *New*, with this Motto over it: VITAE LUMEN MORTUIS REDDIT; with a view to that Text, *Who hath abolished Death, and hath brought Life and Immortality to Light through the Gospel.* Underneath on one Side a Table with Books standing thereon, to signify the proper Business of the Students; on the other a *Diploma*, with the College Seal appended over it, being written MERITI PRAEMIUM, to signify that the Degrees to be conferred are only to be to those that deserve them. On the outside of the Circle, SIGILLUM COLLEGII NEO CAESARIENSIS IN AMERICA; *the Seal of the College of New Jersey, in America.*"

The gentleman who prepared the seal, William Peartree Smith, was a Trustee of the College under its first charter in 1746, and remained such until 1793. He belonged to a New York family "of much taste and refinement," became an ardent patriot, and was characterized by Dr. Hatfield as "one of the most distinguished civilians of the day." In the very year in which the seal was designed, in 1748, he stood in close relations with Governor Belcher. The Governor then described him as "his correspondent in New York," and as "a very worthy and religious young man." There can be little doubt that Mr. Smith looked with reverence upon the man, who had already been the Governor of Massachusetts and New Hampshire was a personal friend of George II, and was addressed in the charter of the College as "our trusty and well beloved Jonathan Belcher, Esquire, Governor and Commander-in-Chief of our said Province of New Jersey," and by the Trustees of the College as its "founder, patron and benefactor." A year earlier, October 8, 1747, Governor Belcher wrote to Mr. Smith concerning the College, and called it "our infant College." His deep inter-

est in its welfare is shown by the published extracts from his letters, by his care to secure a new and better charter, by his efforts and success in locating the institution in Princeton and by his giving it a significant and historic name. As Governor Belcher himself was the President of the Board of Trustees and affixed to the charter the "Great Seal of the Province of New Jersey," what could be more natural than that Mr. Smith should have consulted him in regard to the design of the College seal?

From what we know of Governor Belcher, what colors would he have suggested with greater enthusiasm than the gold and blue of the house of Nassau and the purple in recognition of the Sovereign who had granted this "Royal Charter?" It may be noted, in addition, that the arms of William III, which included the arms of Nassau, were for several years used as the seal of New Jersey, also that Governor Belcher's own coat of arms shows the colors gold and blue and red.

It is, of course, possible that Mr. Smith made the design and selected the colors, and that Governor Belcher and the Board approved of them without any thought of the colors of the house of Nassau, for the seal was made six years before ground was broken at Princeton for the building bearing his name, but the fact still remains that gold and blue and purple have figured upon the official seal of the College from 1748 until the present day.

Note II.—It has been suggested that the colors orange and blue have been already appropriated by other American colleges. I have accordingly tabulated the colleges which have some claim to the colors in which we are interested:—

I.

Beloit College—Old gold.
De Pauw University—Old gold.
Des Moines College—Yellow.
Iowa State University—Old gold.
Southwest Baptist College—Orange.
Syracuse University—Orange.
University of Chicago—Orange.
University of the Pacific—Orange.
University of Rochester—Orange.

II.

Baltimore City College—Orange and black.
Colorado College—Yellow and black.
Princeton University—Orange and black.
Purdue University—Old gold and black.
Randolph Macon College—Orange and black.
St. John's College—Orange and black.
University of Illinois—Gold and black.
University of Missouri—Gold and black.
University of Wooster—Old gold and black.
Vanderbilt University—Old gold and black.
Wake Forest College—Orange and black.

III.

Allegheny College—Old gold and cadet blue.
Bethany College—Yellow and blue.
Buchtel College—Old gold and dark blue.
Bucknell University—Orange and blue.
Columbian University—Orange and blue.
Emory and Henry College—Orange and blue.
Franklin College—Old gold and blue.
Heidelberg University (Ohio) — Orange and blue.
Kentucky University—Orange and blue.
Macalister College—Gold and blue.
Oxford College—Yellow and blue.
Pennsylvania College—Orange and blue.
Trinity College—Old gold and dark blue.
University of California—Gold and blue.
University of Michigan—Maize and blue.
University of Notre Dame—Old gold and blue.
University of Virginia—Orange and navy blue.

IV.

Hobart—Orange and royal purple.

Knox College—Old gold and royal purple.
Northwestern University—Gold and purple.
Portland University — Old gold and royal purple.
University of the South—Gold and purple.
University of Washington—Gold and purple.

There can be no question that the triple combination—purple, blue and gold—the colors of our seal, would solve the difficulty so far as to furnish us with a significant and at the same time a distinctive combination of colors; but I am not so sure that the combination itself would prove satisfactory. The purple would disturb the other colors in much the same way that the idea of royalty disturbs the democratic sentiment. The very man who admitted the purple to the College seal, William Peartree Smith, soon afterwards felt his detachment from the mother country. Dr. Maclean says of him: "He joined Cummings, Livingston and Scott in publishing the 'Watch Tower' in the City of New York, in 1755. He was an ardent patriot, and took a great interest in the struggle between the provinces and the mother country, and lost much of his property by the depreciation of the currency." It was not long before King's-Town, Queen's-Town and Prince's-Town became Kingston, Queenston and Princeton. If, therefore, we no longer choose to fly on our banners the royal purple, it only remains for us in the most practicable manner to adapt the historical ensign of the House of Nassau to the modern emblem of the Sons of Princeton. Gold and blue form indeed a beautiful combination of colors, but for us it would give more recognition to the House of Nassau than to modern Princeton. Orange and blue would recognize both the present and the past. The slight change from black to a dark blue would be an easy transition and a great improvement.

Perhaps the most serious objection to our adoption of the orange and dark blue is the fact that these colors have been used for the last ten years by the students of the University of Virginia, an institution with which we come occasionally into friendly rivalry. The present Chairman of the Faculty writes me that he does not know the reason for their selection, but believes that the students would strongly oppose a change.

In view, however, of the significance which these colors would have for the Sons of Old Nassau, is this objection a sufficient obstacle?

ACADEMIC COSTUME.

At the June meeting of the Board of Trustees a By-Law relating to Academic Costume was enacted as follows:—

Article XXI.

of academic costume.

"Sec. 1. The following academic costume is permitted to be worn upon all appropriate occasions, as indicating the several Degrees and Faculties to which they pertain.

gowns.

"1. Pattern—Those commonly worn, with pointed sleeves for the Bachelor's Degree, with long closed sleeves for the Master's Degree, and with round open sleeves for the Doctor's Degree. 2. Material—Worsted stuff for the Bachelor's Degree, silk for the Master's and Doctor's Degrees. 3. Color—Black. 4. Trimmings—For the Bachelor's and Master's Degrees the gowns are to be untrimmed. For the Doctor's Degree the gown is to be faced down the front with black velvet, with bars of the same across the sleeves; or the facings and crossbars may be of

velvet of the same color as the binding or edging of the hood, being distinctive of the Faculty to which the Degree pertains.

HOODS.

"1. Pattern—The pattern usually followed by Colleges and Universities, save as modified below. 2. Material—The same as that of the gown. 3. Color—Black. 4. Length—The length and form of the hood will indicate the Degree, as follows: For the Bachelor's Degree, the length shall be three-fourths that of the Master's Degree. The Master's Degree shall be of the customary length, not exceeding four feet; and the Doctor's Degree shall be of the same length, but have panels at the sides. 5. Linings—The hoods shall be lined with the official colors of Princeton—orange and black. 6. Trimmings—The binding or edging, not more than six inches in width, to be of silk, satin or velvet, the color to be distinctive of the Faculty to which the Degree pertains, thus: Faculty of Arts and Letters, white; Faculty of Theology, scarlet; Faculty of Law, purple; Faculty of Medicine, green; Faculty of Philosophy, dark blue; Faculty of Science, gold yellow; Faculty of Fine Arts, brown; Faculty of Music, pink.

CAPS.

"The caps shall be of the material and form generally used, and commonly called mortar-board caps. The color shall be black. The Doctor's cap may be of velvet. Each cap shall be ornamented with a long tassel attached to the middle point at the top. The tassel of the Doctor's cap may be, in whole or in part, of gold thread."

"SEC. 2. Members of the Governing Body shall be entitled, during their term of office, to wear the gown of highest dignity —that of the Doctor's Degree—together with the hood appropriate to the Degree which they may have severally received. Members of the Faculties, and any person officially connected with the College who have been recipients of academic honors from other universities or colleges in good standing, may assume the academic costume corresponding to their Degree, as described in the foregoing section, *provided*, that such right shall terminate if such person shall cease to be connected with the College. The President and Dean of Faculty may adopt distinctive badges not inconsistent with the costume hereinbefore described.

THE HON. FURMAN SHEPPARD,

Late Attorney-General of Philadelphia.
Class of 1845.

By CHARLES W. SHIELDS.

There is to most public men a private life which is more or less hidden from the world. In Mr. Sheppard it presented almost a contrast. If he was known as a lawyer who could use the language of the people before a jury and mingle freely in the keen encounters of the professional and political arena, yet he was found to be also accomplished in literature and to take his chief delight in the companionship of books and the society of scholars. Although a man of affairs, he was still a student by nature and by habit. He began in college as a diligent student, and the tastes of a student clung to him throughout his career. In the midst of a busy city, and under all the exactions of a laborious calling, much of the time he lived the life of a recluse student. Of the law itself he was ever a student. It was to him indeed a learned profession, in the old fashioned sense, and not the mere branch of business into which it is sometimes degraded. Instead of being simply proficient in its practice, he made himself a thorough master of its literature and

history and philosophy. As he once himself said of a distinguished jurist: "The law was to him a lofty science, and its practice only the application of ethical principles by a trained logic." There was no field of jurisprudence which he did not explore, and no branch of it which he did not trace to its sources, not merely as found in customs, statutes and precedents, but in the influences of race, climate and government which have moulded the codes of different ages and countries. When but a novice, he published a constitutional text-book, which veterans as well as beginners found instructive. Of his literary services to his profession, others, his associates at the bar, have spoken with an authoritative judgment.

But his studies were not confined to the law and its adjacent fields of research. They were extended through the whole range of learning, giving him a culture as broad as it was thorough and discriminating. The Latin and Greek classics never lost their fascination for him. Instead of using them as a ladder to climb up to a profession and then be thrown aside, he carried them on into all his pursuits as means of mental culture and sources of literary enjoyment. The master-pieces of English prose and verse were not less attractive to him, especially those of the school of Shakespeare, Bacon and Milton, which accorded better with his healthy taste than the less vigorous productions of modern writers and poets. The French, Italian and German literatures were opened to him through a direct acquaintance with the languages in which alone they can be fully appreciated. With growing years he gave his mature thought to the more severe tasks of philosophy, becoming versed in the history and literature of both ancient and modern schools, and at length mastering the brilliant subtleties of German metaphysics, while he inclined to the more sober speculations of the Scottish intellect. Professor Krauth, in the preface to his edition of Fleming's "Vocabulary of the Philosophical Sciences," makes his chief acknowledgment to the "Hon. Furman Sheppard, who, known to the world as one of our most distinguished jurists, is also one of our ripest philosophical scholars and thinkers."

He made a special study of some of the physical sciences for professional use in patent cases and lectures on medical jurisprudence. For treatises on logic, ethics and casuistry, especially of the neglected manner of Aristotle, he had a fondness in contrast with modern habits of thought. But his most singular acquisition was one for which it might have been thought he would have the least fitness or taste. I doubt if any Catholic priest, certainly no Protestant divine, could be more thoroughly versed in the scholastic divinity or more deeply imbued in its spirit. The works of its great masters were in his hands as well as upon his shelves. The lore and logic of the schools, sometimes ignorantly derided as mere jargon, had for him a positive charm. In his admiring fancy, St. Thomas Aquinas, the Angelical Doctor, was all that he was entitled.

He loved learning for its own sake, almost without regard to its uses, as the scientist loves research, as the artist loves his ideal, with a fine scorn of utilitarian ends. A language acquired, a science mastered, a system of thought pursued, were prized on the general principle that all knowledge is refining and ennobling, and may be trusted sooner or later to make itself practically valuable. The result appeared in his general equipment for every task and in his finished performances, even when the sources were hidden from view.

He had a scholar's love of books. Not as the bibliomaniac who amasses books

without knowing their contents in the pride of mere possession; nor yet only as the connoisseur in rare editions and sumptuous bindings; but rather as the student selecting volumes as tools of the mind or contributions to subjects which he was investigating. The result was a rare and rich collection of books representing the fruit of his own earnings, studies and tastes. His library was his retreat from the cares of his profession and the storms of life. There he enjoyed the goodly fellowship of scholars, gathered around him with congenial tastes in literature or law, in philosophy or in divinity. There, too, in the lonely midnight, he held converse, through their immortal works, with

> "The great intelligences fair
> That range above our mortal state."

He had also a scholar's catholicity of thought and feeling, born of acquaintance with books rather than men and based upon the perception of truth as well as error in all schools and systems.

So ripe a scholar might easily have become a great writer. His sinewy and graceful style was especially adapted to productions combining learning with popular effect. The few professional, literary and academic addresses which he published betrayed the culture which was behind them.

To such intellectual attainments were added the moral and physical qualities of a great orator—a strong and musical voice, graceful elocution, intense convictions, cool reasoning ending in passionate earnestness, and withal a robust common sense which could vent itself in terse, trenchant English. A single epithet would sometimes scatter opposing arguments like a bombshell. Brougham was called a thunderbolt. He must have been like that great lawyer and orator in his vehement attacks upon crime and corruption; and like him, too, in that he failed, when he failed, simply because he was on the unpopular side, never losing the respect of those who could not give their votes, but rather heightening that respect by his natural modesty and self-control, alike under success and defeat. Had he lived in less troublous times, or been less true to his life-long convictions, his voice would certainly have been heard in the counsels of the nation, and he might have gained the highest prizes of his profession.

To *be* rather than to *seem* was the habit of his life. Content with himself, he had no need of pretence or profession. His genuine manhood, his integrity, his kindliness and generosity, and all his high ideals were impressed without effort and without self-assertion upon every one who knew him.

Religious training combined with intellectual tastes to make him a lover of good preaching and good men. He ever respected the ministers of religion in all denominations, never more than when they stood faithfully in their place doing their duty. Of those admitted to his friendship, whether scholarly priests or learned divines, none could ever question his devout feeling and lowly faith.

THE SIXTH INTERNATIONAL GEOGRAPHICAL CONGRESS.

Fourteen years ago a festival was held in Antwerp to celebrate the unveiling of the statues of Mercator and Ortelius. In connection with this gathering the first Geographical Congress was assembled. It has met at irregular intervals since that time, and has gained in popularity with each new session. The second meeting was held in Paris in 1875; the third in Venice in 1881; the fourth in Paris in

1889; the fifth in Berne in 1891, and the sixth during the past summer in London.

The meeting was a great success in every way; its organization was very complete and comprehensive, and every detail was executed with such precision that the assembly was most thoroughly enjoyable.

A large number of valuable papers were read, and the discussions which they drew out were very profitable. The arrangement of the programme was peculiarly felicitous, in that the great divisions of the subject matter of geography were considered topically. Thus the general sessions were occupied with papers and discussions upon such subjects as Geographical Education, Polar Explorations, the development of Africa, and Exploration and Cartography in general. The more technical papers were read before the sectional meetings, two of which met simultaneously each afternoon. The subjects brought before these meetings were such as Photographic Surveying, Geodesy, Physical Geography, Oceanography, Limnology and Geographical Orthography and definitions. In this way the broader geographical ideas were kept prominently before the Congress to the exclusion of the purely technical portions. Results were looked for rather than minute technicalities, and in this way the effort was made to further the more general interests of all geographers. In this, the arranging hand of the committees was clearly seen, as even the sectional meetings were provided for, by the request sent out months in advance, for papers which were to be prepared upon specific subjects and presented upon definite days during the meeting.

In connection with the meeting a series of exhibitions was held. Many of the governmental surveys were represented by large series of maps. These were supplemented by the contributions or loans of the Geographical Societies and individuals. Another department consisted of paintings and photographs of geographical interest. Here were the historical portraits of eminent travellers, cartographers and writers; photographs from all parts of the globe, contributed by explorers; lantern slides and diagrams prepared for use in connection with geographical education. A most noteworthy collection of ancient maps was exhibited, illustrating the growth of cartography from the time of Ptolemy to the beginning of the present century. This set contained many rare and priceless charts. There was also an exhibition of geographical instruments which was very instructive. This collection was historical in many respects, and therefore of great interest.

Professor Libbey attended the Congress as one of the delegates of the American Geographical Society of New York and of the National Geographic Society of Washington. He contributed to the exhibition a series of pictures from the Hawaiian Islands and another from Greenland. He read a paper before the Congress upon the relations of the Gulf Stream and the Labrador Current, delivered one of the two illustrated evening lectures, the subject being Greenland, and was made one of the acting Vice-Presidents of the Congress.

The next Congress will be held in Berlin in 1899.

THE PRINCETON SCIENTIFIC EXPEDITION OF 1895.

By J. B. HATCHER.

Last season's expedition to the West was composed of the following gentlemen: Mr. A. A. Brownlee '89, Mr. F. J. Moses '92, Messrs. J. W. Garrett, Walter Moses

E. R. Otheman and L. F. Pease '95, S. B. Davis, A. L. P. Dennis, R. F. Little, Jr., A. G. Milbank, T. E. Pierce and J. H. Scheide '96. It was in charge of the writer, and selected for its field of operation the Uinta or upper Eocene deposits in the Uinta Basin of northeastern Utah. As in previous years, the chief object of the expedition was the collecting of mammalian fossils, and in this work it was very successful. Although fossils are quite rare in the Uinta beds, and are at present represented in only three museums of the world, yet a fairly representative collection of all the forms heretofore known from these beds was secured, as well as several forms entirely new to science.

Among the more interesting finds may be mentioned the following. Two species of *Mesonyx* are represented by nearly complete skulls. There are parts of two skulls doubtfully referred to *Didymictis;* among other carnivorous forms are *Miacis*, *Hyænodon?* and the superior dentition of the earliest true carnivore yet known and representing a new genus and species. Among rodents the genus *Paramys* is represented by an abundance of material, and there is a beautiful skull of a small rodent which has lately been described by Prof. Scott* and made the type of a new genus, *Protoptychus*. That author has shown that this genus is related to the Dipodidae or jumping mice, and the fact of finding this type in the Uinta establishes for this family a much earlier ancestry than had been supposed to belong to it. Among Perissodactyla the genera *Telmatotherium*, *Amynodon*, *Triplopus*, *Isectolophus*, *Epihippus* and *Diplacodon* are represented. The *Triplopus* material is especially good, and we were fortunate in securing the only skull of *Diplacodon* known. This fortunate discovery has enabled the writer† to give for the first time the principal characters of the skull of this genus and to clear up several doubtful points regarding its phylogeny. There are in the collection several jaws of a small Lemur. Insectivora are also represented. The material is especially rich in Artiodactyla. There is a skull and lower jaw of *Achænodon;* several complete skulls and nearly complete skeleton of *Protoreodon;* a splendid skull, fore and hind limbs and feet of *Leptotragulus;* skull and much of the skeleton of *Hyomerix* and *Oromeryx*, as well as important material of several other new or little known artiodactyls.

The Dinocerata are represented by fragments of *Uintatherium*.

The fossils secured by this expedition fill an important gap in the collections of the museum, and make it possible for the student of Vertebrate Paleontology to study collectively the Bridger, Washakie, Uinta and White River faunas which are now well represented in our collections. It is the purpose of the department to bring together as rapidly as possible complete representative collections of vertebrate fossils from all the Mesozoic and Tertiary beds, and to arrange the material so that it will be easily accessible to the student.

After finishing the Paleontological work of the expedition the party visited the Yellowstone National Park, going by teams and saddle horses as far as the mouth of Horse Creek, on the upper Wind River, where a "pack outfit" was secured and the remainder of the journey accomplished in that manner. While this part of the trip was largely recreative, yet it was not without direct scientific results and was especially instructive to the student members of the party.

Owing to rumored Indian troubles in

* See Proc. Acad. Nat. Sci. Phil. 1895, pp. 269-286.

† See *Am. Naturalist*, Dec. 1895.

Jackson's Hole, through which the regular trails from upper Wind River to the park led, we chose a route some 75 miles to the eastward, in order to avoid any possibility of trouble with the Indians, and so as to give no cause for anxiety to friends in the East. The route selected should be known as the *Princeton Trail.* Leaving Dubois, at the mouth of Horse Creek, on the afternoon of July 14th, with a pack train of 18 men and 27 horses, we proceeded in a northwesterly direction until we reached Du Noir Creek, a tributary of Wind River, some six miles above its mouth. We ascended this creek to the head of its middle fork, which is on the western flank of one of the highest and most prominent peaks in this part of the Wind River range. Not finding this peak located on any of our maps, we christened it Mt. McCosh, in honor of our deceased president. Mt. McCosh is situated between the eastern and central forks of Du Noir Creek, and is about 12,000 feet high. It consists of a high, narrow ridge about four miles in length from north to south, and ascends some 2,000 feet above timber line. At the time of our visit, July 17th, it was entirely covered with snow. Its western slope is easily ascended, but its eastern is more abrupt. The northern end of this mountain forms the crest of the Continental Divide and affords a commanding view of the surrounding country. Far to the west may be seen the magnificent, jagged Tetons; to the north and eastward are Yountz, Garfield and a host of minor peaks; away to the southward, in the foreground, is seen the beautiful Wind River valley, and in the distance Fremont's peak and the principal Wind River range, now white with last winter's snows; radiating from its base are innumerable deep and rugged cañons, homes of as many mountain torrents, some leading eastward, others to the west. Clustered in a small valley at the southeastern base of the mountain are several picturesque little lakes. It is indeed a magnificent scene, and Mt. McCosh, situated as it is at the headwaters of the most eastern branch of the largest river in America tributary to the Pacific is calculated to impress the visitor as the veritable backbone of the continent.

From Mt. McCosh our route for three days lay along the crest of the Continental Divide, descending each night to the timber line to camp. The Divide at that season, July 17–19, was entirely covered with snow, which when not too soft made an excellent road bed. On the evening of July 19th, we descended to the left bank of the upper Yellowstone River, camping about 30 miles above where that stream enters the lake. From here we continued down the river to the lake and across to the head of the west finger of the lake and thence on an air line over Flat Mountain to the thumb of the lake, which we reached July 22nd. We then proceeded by the usual routes to points of interest within the Park, returning by the Cook City and Clarke's Fork trail through the Big Horn Basin to Casper, Wyo., and thence by rail to the East.

A few observations made in the higher altitudes reached seem worthy of notice. We were greatly impressed by the injury to the spruce and pine forests due to the Porcupine. In many places fully one half the trees were injured, many of them fatally, by these animals. This injury was due to the barking of the trees to procure food in winter when other sources of food supply for these creatures were shut off by the snow. The barked area was usually from 12 to 18 inches in length, frequently, completely encircling the tree and it was situated anywhere from 1 or 2 to 18 or 20 feet from the ground, doubtless varying with the depth of the snow at the time the

injury was done. The number of trees thus injured was simply incredible.

All of the higher peaks and ranges along the route traversed are composed entirely of igneous materials and many of the highest peaks are made up of volcanic conglomerates. This is especially true about the head of Du Noir creek.

During the three days we were on the Continental Divide only one species of animal life was seen, though doubtless later in the season it is a favorite resort for the larger game animals. The animal referred to was a small bird, probably a species of ground lark. This was observed nesting on three different occasions, and in each instance the nest was built in a recess excavated slightly beneath the surface of the ground, a precaution taken doubtless as a protection from frequent storms. Several colonies of the red variety of Protococcus were seen flourishing in the snow.

Of all the routes to the Park the "Princeton Trail" is without a rival as regards venturesome mountain climbing and picturesque scenery. The very roughness of the route precludes the possibility of its ever being much frequented; but for a party of young men, such as ours, seeking something out of the regular line and not minding "roughing it a bit," it is strongly to be recommended, and once taken will be long remembered.

It would be impossible to thank here all who extended their aid and kindness to us. To Major Cramer, commanding officer at Fort Washakie, and Captain Pitcher of the same army post, and to Captains Anderson and Scott of Fort Yellowstone, the members of the expedition are especially grateful, as also to Rev. and Mrs. Mooney and other citizens of Lander, Wyo. For important aid in advancing the work of collecting fossils in Utah we were indebted to Major James F. Randlette of Fort Duchesne, and to Mr. Clark, clerk in charge at Ouray Indian Agency. For transportation we are under obligations to the Baltimore and Ohio; Atchison, Topeka and Sante Fe; and the Chicago and Northwestern Railways. In behalf of the College I wish to thank the various members of the expedition whose generosity alone made it possible, and my personal thanks are also due the party as a whole. I am especially indebted to Mr. Walter Moses for his interest and aid in organizing and equipping it.

THE SCIENTIFIC SPIRIT.

By G. MACLOSKIE.

My best course will be to explain why scientific investigators hold these annual congresses, what sort of men they are, and especially what is their attitude toward Christianity. They meet for the purpose of criticizing each other. No discovery in science is accepted until it has run the gauntlet of such criticism. Not only must a man know that he is right in his alleged discovery, but he must marshal his evidence so as to convince others, and must face objections or admit his errors. Hence the benefit of these meetings, which have been at the foundation of all scientific progress. The same critical spirit is shown towards pseudo-science, and has been instrumental in destroying belief in witchcraft and astrology, thus delivering us from the reign of error, and it would have long ago killed Christianity if Christianity had been killable. Such criticism is eminently wholesome; and more of it is needed, for as regards scientific matters our laity (including a large proportion of our college-bred men) are still in the dark ages. I may here put in evidence the documents recently received, with the endorsement of eminent educationalists and divines, which condemn original research in Biol-

ogy, and threaten legislation that will relegate our colleges to the kindergarten methods of models and diagrams.

It is true that mistakes are often made by scientists. Few of them have studied the evidences of Christianity, and most of them have been too busy in the laboratory to frequent prayer-meetings. When I first came in as a stranger among them I was under the impression that they were chiefly a ring of sceptics, and I expected rough times, especially as I know that I deserved criticism. But I soon found many of those most highly honored among them to be men of God; and without exception, from Christian men like Asa Gray, to Mr. Huxley and men of his type, they showed me nothing but kindness, and I found no general animus against Christianity or its representatives. Of course Huxley has often written severely of things that are dear to us; he was, in fact, color-blind as to the religious side of things; and when attacked he liked to hit back, especially if the assailants were church dignitaries, who claimed a right to teach him how he should study science. One of his fine hits was his defence of prayer against an English Bishop who had renounced his faith in its answer. Huxley showed conclusively that if we believe in God we should believe that He is both able and willing to grant our petitions. Huxley was honest, and ready to confess a mistake; and his error was the very common one of fancying that when you have got a complete scientific explanation there is no room for the supervision of a Higher Power.

In America the man who did most to benefit science was the man who also made most blunders and did most mischief, namely Louis Agassiz. The clergy are often blamed for opposing new measures, but the leader of the opposition was Agassiz. Whilst Dr. McCook has lately shown that the distribution of the same kind of spiders round the globe is consistent with community of origin, as they are carried by the trade winds, Agassiz would have solved the same problem by the grotesque hypothesis of manifold creations of the same species in different spots, and by creations in multiple for each spot; and he was furious when Darwin undermined his speculative curiosities. As the clergy deemed Agassiz semi-inspired, and their views about fixity of species and creation did not easily blend with new ideas, they were misled, and some of them went so far as to publish the doctrine that Darwinism was infidelity. I suppose they did not generally intend to stigmatize Asa Gray and James McCosh as infidels: but this was the inference easily reached from their writings. When I came to America I found that worthy men and even religious newspapers were suggesting or plainly saying that Dr. McCosh was inclined to scepticism, and that Princeton College was a dangerous place. This is very unlike the spirit of Him who commanded us to "consider the lilies how they grow," and whose presence with us is the greatest charm in our study; and they lose much who study nature forgetful of their God, as on the other hand men lose much who think of God but do not study His works. There was great danger of our churches being driven, by the condemnation of evolution, into an attitude of antagonism to science, which would have been disastrous both to religion and to science. It was Dr. McCosh who did most to avert this disaster. He studied up the subject, so as to treat it with real ability; and by showing that evolution, when properly understood, is consistent with faith in God and in His Holy Scriptures, he convinced people that evolution, whether right or wrong on the merits, is at least not dangerous, and thus he provided a *modus vivendi* between science and faith.

[Notes of an address at a union meeting in South Church, Springfield, Mass., during the recent meetings of the American Association.]

ORIGINAL CONTRIBUTIONS.

EMBRYO OF LEPIDIUM.

By G. MACLOSKIE.

Whilst the cruciferous genus *Lepidium* is characterized by the incumbent folding of its embryonic leaves or cotyledons, the latest text books represent the common pepper-grass, *Lepidium virginicum*, L., as exceptionally having incumbent cotyledons. In 1876 I found that the apparent anomaly was due to a twist of the pedicles of the cotyledons within the seed; but I was informed by Professor Goodale, that this discovery had been made and published by another, though it has never even yet found its way into the books. While recently engaged in the investigation of antidromy, it occurred to me that this principle might explain the condition of the embryo of the pepper grass; and I ventured to predict that the twist in the two seeds contained in each silicle would be in contrary directions. I have now found by careful dissection that this is so, making it an interesting confirmation of the view that antidromy depends on the place and mode of origin of the seeds. This observation also disposes of the apparent anomaly, by showing that *L. virginicum* has only an exaggerated development of the antidromic torsions that exist in all seeds.

PRINCIPLES OF MARINE ZOÖGEOGRAPHY.

By ARNOLD E. ORTMANN.

The beginning of research in the geographical distribution of animals can be traced back about fifty years, but we can not recognize a scientific treatment of the subject until the more recent times. The peculiarities of the distribution of the animals on the surface of the earth, often very strange and interesting, very early attracted the attention of scientists, but, for the most part, they merely recorded the simple facts in a statistical manner; and according to the "habitat" of certain animals, according to their presence or absence from certain parts of the earth, they distinguished certain realms, regions, provinces, etc., each characterized by a peculiar fauna. In order to obtain a criterion for distinguishing those zoögeographic divisions, the similarities or dissimilarities of the actually present faunas were counted. As natural, the more important and conspicuous groups of animals, especially the terrestrial vertebrates (mammals, aves, etc), were the first to be investigated, while the other groups were more or less neglected.

The first attempts, however, in investigating the distribution of animals in a scientific way were made in marine animals, as these researches were not restricted to a mere statistical statement of the range, but directed attention to the natural causes of the peculiarities and to the physical conditions of the earth influencing the distribution. These investigations were made by *Dana* in his famous reports upon the Reef Corals and Crustaceans of the U.S. Exploring Expedition. Subsequently the physical causes of the distribution o terrestrial animals were studied by *Wallace*, and the book published by him is the standard of zoögeographical knowledge up to the present time, and all the more important contributions of other authors are based upon the principles outlined by *Wallace*.

But all the studies in Zoögeography, although pointing to the importance of the examination of the physical laws that govern the distribution of animals, did

not apply this method in dividing the surface of the earth into faunistic divisions, and until the most recent times the zoölogical statistics (chorology) were the only method used in constructing zoögeographical regions: according to the number and supposed importance of "characteristic" genera and species each region was determined and separated from the others.

It is one of the greatest inconveniences in this old method, that the attempt was made to show that the whole of organic life, animal as well as plant, was ruled by the same laws; *i. e.*, the same geographical divisions should be employed in each separate group of life. Others went so far as to claim that such a standard division must necessarily be found. In spite of this, many authors very soon discovered that the different groups of animals were distributed according to different laws, and the most striking difference was found to be that between terrestrial and marine animals. This division was complicated by *Guenther*, who divided the fishes into five "categories": fresh-water fishes, brackish water fishes, shore fishes, pelagic fishes, and deep-sea fishes. The principle of this division, not clearly understood by *Guenther*, was fairly well conceived by *Moseley*, who showed that certain "peculiarities of conditions of existence" make up the differences of these "categories." This idea was adopted very recently by *J. Walther*, and he has tried to give a complete analysis of these differences, at least as regards the marine life, but it is much to be regretted that the discussion of details in *Walther's* "life-districts"* is given in a somewhat hasty and logically insufficient manner, so that many objections may be made to the number and characters of most of his life-districts: the six marine life-districts distinguished by him are partly very poorly founded and half of them should be dropped.

As *Moseley* pointed out, certain fundamental differences of conditions of existence characterize the life-districts, and examining the matter more closely, we shall find that the main differences are made up of the conditions of the *light*, *medium* and *substratum*, and according to the different features of these three conditions we can distinguish as follows:

1. Light. The medium is air. Substratum present—Terrestrial district.
2. Light. The medium is fresh water. Substratum present—Fluvial district.
3. Light. The medium is salt water. Substratum present—Littoral district.
4. Light. The medium is salt water. Substratum wanting—Pelagic district.
5. Dark. The medium is salt water. Substratum present—Abyssal district.

These are practically the most important life-districts, and, as a rule, every form of animal life is restricted to one of them. But there are a few exceptions, that is to say, sometimes certain animals migrate from one district into another: such changes, however, are regular ones, and are governed by strict laws. Any artificial or unnatural transplantation of a species from the proper life-district into another involves the impossibility of its farther existence.

The differences of the life-districts given by the principal external conditions of existence are not the only ones influencing the distribution of animals. On the contrary, we can observe that very different faunas are often present within one and the same life-district. Such differences are often of that kind designated as due to the "facies." This term is first

*The German word is "Lebensbezirke," which is first given in English by *Quereau* (Tourn. Geology. Chicago II. 1894, p. 858,) as "life-zones." But as the term "zone" is employed in geographical science in a strictly climatologic sense, we suggest "life-district."

employed (by *Gressly*) to define the peculiarities of geological deposits formed at the same time, and its use may be extended obviously to the recent conditions (*Neumayr*), and farther, it may be transferred from the marine deposits to those formed in fresh water and even on the continents (*Walther*). Thus "facies" are the differences of the material forming the uppermost strata of the Lithosphere (the solid crust of the earth). It should be remarked that this term applies to the substratum, and, therefore, it can not be employed in the pelagic life-district, as the latter has no substratum. Of the other life-districts each has its own facies, characterized as well by the lithological composition of the substratum (primary facies), as by secondary elements, due to deposits formed by organisms living on the substratum (vegetation, colonies of certain animals, etc.)

The different species of animals are mostly adapted to one peculiar facies; sometimes, however, a species is not very particular in preferring a certain facies, but is found under various conditions. (A number of cosmopolitan animals belong to the latter group.)

Concerning the dispersal of the animals, it is very important that both the different life-districts and the facies should be in a certain degree *continuous*. Either of them may extend over large areas of the earth, but often there are discontinuities which may be more or less important. If the interruptions of continuity are only small ones, as to form no barriers against the wandering of the inhabitants of the different localities from one place to others, we may say that the continuity is still preserved. On the contrary, in the case that the topographical continuity is interrupted in such a way that the intervening spaces between the localities fitted for the existence of a species are so broad as to form a barrier against the farther distribution, that is to say, in case the species concerned is not able to trespass across the gaps by peculiar "means of dispersal," we may say that there a *topographical barrier* is present. The result of such topographical barriers is that the dispersal of the species from its centre of origin is limited at certain points, and it becomes impossible for this species to migrate into other parts of the earth, although the proper life-district and the proper facies are present there. The topographical continuity of the range is a fundamental principle influencing the dispersal of animals.

As regards this point, the different life-districts present great variety. Especially the terrestrial district is composed of a great number of larger and smaller parts isolated from each other more or less completely. It is very remarkable that this character of the terrestrial district, its composition of a number of isolated pieces, is a very ancient one, as it is apparent, that also in former geological times, even since the first appearance of land, the same was the case. In a similar manner, the fluvial district, the rivers, lakes, etc., containing fresh water, is divided into a great number of discontinuous parts, each of which may be roughly defined as characterized by the main river system, to which its waters belong.

On the contrary, the three marine districts are distinguished by a pretty complete continuity. The least developed is that of the littoral district, of which those parts adjoining the oceanic islands and groups of islands are separated from the others, but these separations are seldom of any importance. The main part of the littoral district, following closely the course of the coasts, is absolutely continuous, this continuity being maintained

especially on the northern hemisphere. The pelagic and abyssal life-districts are completely continuous all over the earth.

Besides the topographical features here discussed, we must direct our attention to another very important factor influencing the distribution of animals: the differences of the *climate* of the earth. The influence of temperature upon animal life is well known, but in the more recent times it was found out that not so much the absolute height of temperature as the amount of the yearly change of temperature in the same locality is to be considered. According to this view the animals are divided into *stenotherm* and *eurytherm*. This dependence on the temperature is very great in marine animals, whose body-temperature changes with that of the surrounding water, while a great number of terrestrial animals is not so much influenced by temperature changes, being adapted peculiarly to them (viz., by warm blood).

Finally, there are *biocœnotic* conditions influencing the distribution of animals. Most of the animals are dependent on each other, and the continuity of biocœnotic conditions favors the distribution, while a discontinuance of this condition proves to be a *biological barrier:* thus the absence or presence of certain animals in a particular locality is a condition for the existence of others there.

As stated above, small interruptions of the continuity of the topographical, climatic, or biological conditions are often not able to form barriers, because the species concerned possess means of surpassing these barriers. These "means of dispersal" are studied carefully by a number of authors, especially by *Wallace*. But in this respect one must bear in mind that the means of dispersal of the various groups of animals are often very different, and sometimes conditions forming barriers against certain animals favor the dispersal of others. To this cause it is due that the former attempts in treating the geographical distribution of the whole animal kingdom were unsuccessful, because the results obtained in one group could not be transferred to others without important changes.

In order to construct marine zoögeographical regions on the surface of the earth, we are to disregard each definite group of animals, and to investigate only the *physical* conditions influencing the distribution. Only by so doing can we define regions more generally valid. Farther, because the physical conditions are different in each of the life-districts, we have to treat each district separately, and, accordingly, we will find that each district is to be divided into regions peculiar to it.

The most important conditions influencing the distribution of marine animals are given by the differences of the climates, and it is very interesting, that the topographical conformations of some life-districts can not affect the distribution of animals but by the aid of the existing climatic differences. The main features of the climatic variations may be characterized as follows. The circumtropical zone shows temperatures of a nearly constant height, the variations amounting only to comparatively a few degrees: especially the waters of the tropical seas are during the whole year warm and nearly of the same temperature. Going farther northward, we find that the average temperature of the year decreases, while the amount of the changes in temperature increases, and coming near the poles, we find that both the average temperature and the amount of changes decrease, so that we have in the arctic seas both a very low mean temperature and very small changes. The decrease of the temperature

changes in arctic seas compared with the temperate ones is very remarkable, and, accordingly, we have to draw the main limits of temperature zones on the earth, where the equally warm temperatures of the tropics are limited by the beginning of important changes in climate during the year. The differences between the latter conditions prevailing in the so-called temperate zones and the conditions of the frigid seas, where a cool but more equal temperature prevails, are in no way as important for animal life as the differences first named.

These limits between the tropical and temperate conditions of the seas can be traced in the following manner. In the northern Atlantic Ocean we may draw a line from Cape Hatteras on the coast of the United States to southern Spain, denoting the northern border of the tropics; on the Pacific Ocean this line runs from near Tokyo, Japan, to California. In the southern Atlantic a line running from the mouth of the La Plata in a northeasterly direction to some point on the West African coast borders the tropics southward, and the same line may be continued from the eastern shores of Cape Colony across the Indian Ocean to the western coast of Australia, from the eastern coast of this continent to New Zealand, and from there to Peru. The accurate course of these limits can not be made out correctly over all the parts of the oceans concerned, because reliable observations of the sea temperatures are mostly wanting. Notwithstanding, on some points we can fix these limits more accurately by the aid of the well-known course of the great ocean currents, coming either from the North or from the South, and approaching often so closely together that they form abrupt changes in the water temperature.*

* The correct tracings of these lines across the oceans from coast to coast would be a most desirable object of farther investigation.

It is very important that these principal limits of climatic conditions of the sea water, although mostly still hypothetic, show certainly such a course, that the two great continental parts of the earth, the old and the new world, reach both on the northern and southern hemispheres into those parts of the earth characterized by considerable changes of temperature, and thus the whole of the circumtropical zone of the oceans is divided into separate parts, and this combination of climatic and topographical conditions enables us to divide the separate life-districts into zoögeographical regions.

Within the *littoral district*, first we have to distinguish three great climatic belts: the arctic, circumtropic, and antarctic. The arctic belt maintains its topographical continuity, and may be designated as the *Arctic region*. But within this region three subregions may be distinguished. The southern limit of the coast-ice in summer affords us a good line of secondary value, as in the regions where the polar ice is present during the whole year, the temperature of the coast water is nearly stationary, and the amount of the changes in temperature is the smallest possible. This very well known limit of the summer ice divides an *arctic circumpolar subregion* from two subregions situated more southerly and perfectly isolated from each other: the *atlantic-boreal* and the *pacific-boreal subregions*.

The circumtropical belt of the littoral district is divided into four isolated parts, which may be designated accordingly as four regions. Each of these regions follows the course of either the eastern or the western coast of one of the two great continents, and they are separated from each other by the continental masses or by the free expanse of the oceans. The first is the *Indo-Pacific region*, extending from the southern end of Africa along the

East-African and South and East-Asiatic coasts, crossing over the Indo-Malaysian islands to Australia, and comprising the small islands of the Pacific ocean, which, although being actually separated, lie so close together as to form no sharply isolated parts within this vast area of the littoral district. The second region is the *West-American*, following the western coast of that continent from California to Peru, being separated from the Indo-Pacific region by the broad surface of the Pacific ocean. The third region is that formed by those parts of the littoral adjacent to the eastern coast of America from the southern United States to southern Brazil, and may be called *East-American region*, and the fourth is situated on the opposite side of the Atlantic ocean, comprising the tropical West-African coast and the Mediterranean sea: this may be called the *West-African region*.

The third climatic belt, the antarctic, contains only comparatively small and isolated parts of the littoral, that is to say, the southern ends of the continents: South America, South Africa, South Australia, and the larger and smaller islands of the Antarctic sea. On account of the smallness of these separate portions we may combine the whole of the antarctic littoral in *one* region, the *Antarctic*, which may be subdivided into local faunas.

The *pelagic life-district* is influenced in a similar manner by the combination of climatic and topographic conditions, but the division into regions is somewhat different, because the great oceans, the Indo-Pacific and the Atlantic, are separated only by the two continental bodies, thus forming only two separate parts within the tropics. Accordingly, we have here, as in the littoral district, an *Arctic region*, subdivided into an *arctic-circumpolar* an *atlantic boreal*, and a *pacific boreal subregion*. Within the circumtropical belt, however, we have only two regions: the *Indo-Pacific* and the *Atlantic*, and a fourth region is formed by the *Antarctic* seas, whieh may be subdivided, using the northern limit of the summer ice, into an *antarctic* and *notalian subregion*, both preserving a circumpolar continuity.

Very different are the conditions of the *abyssal district*. As this whole district is characterized by a low and very nearly constant temperature, no climatic zones can be distinguished, and farther, as this whole district is continuous throughout its extension over the bottom of the oceans, no topographical divisions are present. Therefore we cannot establish any zoögeographical regions within this district, which agrees with the well-known fact that most of the true abyssal animals have a world-wide distribution.

For zoögeographical studies we have thus divided those parts of the earth, which are occupied by the oceans, into the following regions:—

I. Littoral life-district.
   1. Arctic region. 2. Indo-Pacific region. 3. West-American region. 4. East-American region. 5. West-African region. 6. Antarctic-region.

II. Pelagic life-district.
   1. Arctic region. 2. Indo-Pacific region. 3. Atlantic region. 4. Antarctic region.

III. Abyssal life-district.
   No regions distinguishable.

The above are the zoögeographical conditions of the oceans as observed in the present times, yet in former times we find other conditions of things. During the geological development of the surface of the earth the climatic as well as the topographical features have undergone important changes. Differences of climate are said to have been present (according to *Neumayr*) even in the Jurassic period,

but this seems to be very improbable, as the argument given by *Neumayr* is defective in some very important points: especially his demonstration that the faunistic differences observed by him in the upper Jurassic deposits are due to climatic causes and *not* to topographical ones, is not convincing. On the contrary, we believe that even these differences are to be referred to the topographical conformation of the Jurassic seas, and we suppose, like many other authors, that climatic differences were not present before the beginning of the Tertiary period. Accordingly, we must assume that in pretertiary times there prevailed a nearly equally warm climate all over the earth, and, therefore, climatic barriers against the distribution of animals could not exist. But it is not impossible that there were present some peculiar topographical features in the configuration of ocean and land, so as to form definite topographical divisions, Such topographical conditions are not yet stated positively by geology, and if such were present they could, among the marine life-districts, only be present within the littoral. Only this district could have been divided into separate parts, while the open ocean was certainly continuous as it is nowadays. As regards the abyssal, one must bear in mind that this district could not be present in those times with exactly the same characters of the recent abyssal district; that is to say, it could not be a *cool* abyssal. Thus this district in its present form is to be regarded, geologically, as the most recent one.

But even in the Tertiary period, during which climatic differences were certainly developed, the limits of the zoögeographical regions were often very different from those of the recent time, because the topographical features of the seas were different. As the most important difference should be regarded the continuity of the circumtropical belt maintained during a great part of the Tertiary. This continuity was due to the well-known fact, that the connection of North and South America was not yet formed, and, perhaps, that there was present a communication of the southern European seas with the Indian Ocean. The separation of the Mediterranean Sea from the Red Sea and the Indian Ocean, and its connection with the Atlantic Ocean, and especially the separation of the Pacific Ocean from the West Indian seas by the rising of the Isthmus of Panama, were the last steps accomplishing the development of the recent conditions, and the latter are, geologically spoken, of a very recent date: they were not formed until the second half of the Tertiary period.

The above are the general principles of marine Zoögeography, which should guide any detailed investigation of the distribution of the different groups of animals, and in each case attention should be directed to the question, how far these principles may be applied. We may expect that in many groups the actual distribution is in accord with the regions constructed above; but, on the other hand, we shall not be surprised if the distribution of some animals does not agree with the recent regions, but suggests that the conditions present in former times are still recognizable. The manner of research hitherto most commonly employed, *i. e.*, the stating of the range of animals in a purely statistical way, and the grouping together of the animals into regions according to their actual "habitat," should be rejected, especially because such species pointing to the former conditions, and such ones influenced by the more recent conditions, may be mixed in each systematic group; and, if that is the case,

we can not obtain a fair and instructive idea of the peculiarities of the distribution.

There is no doubt that, for the purpose of studying the distribution as regards its geological development, we need not only the knowledge of the actual distribution, but we have to make exact studies in systematic, natural affinities, geological and palæontological history of each group, and further, we need studies of the biology and bionomy of each. Only by so doing are we enabled to understand fairly the actual distribution; and, on the other hand, the zoögeographical facts properly understood, especially their deviations from the normal condition, can throw some light upon the origin of the different groups, and even may give information on the geography of the earth in former times. The Zoögeography thus treated will be not only one of the most interesting branches of Zoölogy, but will be likewise important for the geographical, geological and palæontological sciences.

[Summary of a book entitled: *Grundzüge der marinen Tiergeographie*, published by G. Fischer, Jena, 1895.]

SUMMARIES OF PAPERS READ BEFORE SCIENTIFIC SOCIETIES.

ANTIDROMY IN PLANTS.

By G. MACLOSKIE.

In the Princeton College Bulletin of November, 1893, I published the discovery of dimorphism among Maize Plants, and traced its origin to what I now term "Antidromy" (twisting in opposite spirals), between the embryos of the seeds of adjoining rows on the ears. I now find (by growing the plants from the grains in order) that two-thirds of the grains in the row opposite my right hand have the left margin of their leaves external, and the other third have their right margin external, these proportions being reversed for the row opposite my left hand.

During the past summer I have succeeded in tracing this especial kind of duplicity through the whole Vegetable Kingdom (including the Coniferæ, but excepting the Flowerless Plants. I think, however, that there are indications of it in some of the acrogens). Of every species there are two castes of individuals, born of the same mother-plant, and differing by having a right-handed twist or tendency to twist in one set, and a left-handed twist in the other set. This antidromic bias appears to depend on the fact that the mother-seeds of some of the plants were borne on the right margin of a carpel, and of others on the left margin. The effect is to influence the structure of the seed, its embryo, and the stem, phyllotaxy, anthotaxy, and in some cases the structure of the carpels of the forthcoming plant. Antidromy being primitive, is often concealed by secondary changes, as by twinings of stems, spreading-out or opposition of leaves, and crowding of flowers; and exact bilateral symmetry of any part destroys the evidence between dextrorse and sinistrorse twisting. Usually, however, there is some vestige of the evidence remaining. When plants are produced from one individual by cuttings, bulbs, or buds, they are, like branches of the same plant, homodromic. But in some cases, as Iris, Calla-lily, and Rush, I believe that the same rootstalk produces antidromic plants; and the branches of a single Bilated-tree (*Liquidambar styraciflua*) are relatively antidromic, some subbranches from the same branch being dextrorse, others sinistrorse, though a

branch maintains its character unchanged. Old observations assigning opposite spiralism to cones of the same Larch or Pine-tree, were perhaps caused by the fact that the cones on opening to discharge the seeds apparently change their spirality; but I find the young cones harmonizing with the phillotaxy. The anchoring cord-like scapes of *Vallisneria spiralis* twist with opposite spirals at the two ends. This was shown by Darwin as to tendrils of other plants to be a mechanical device for approximating the ends. Prof. Brackett kindly suggests the term *didromic* as qualifying that kind of twist. Besides its didromy, Vallisneria is also antidromic, for if one plant has the upper part of cord dextrorse and the lower part sinistrorse, another plant will have these features reversed.

This law raises problems about heredity being partly different on opposite sides of the same organ; or perhaps the bias arises from a mechanical or nutritive diversity between the two sides; it opens new lines of research, and answers some old problems.

Phyllotaxy, which was once condemned as a botanical factor, must be restored as part of a wider law, but not in the old artificial style.

It may explain such a case as the contrary spirality of two telegraph poles of the same species; and the sculpturing of the bark of Chestnut and other trees more or less conforms with their phyllotaxy.

[Paper read before the Botanical Section of the American Association; also published in *Torrey Bulletin*, September, 1895, and *American Naturalist*, October, 1895.]

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JONATHAN DICKINSON AND THE FOUNDING OF THE COLLEGE.

Jonathan Dickinson, the first president of the College, was the second child of Hezekiah and Abigail Dickinson. He was born April 22nd, 1688, at Hatfield, Mass., and was graduated at Yale College in 1706; entering that Institution probably in the first year of its existence. Where he studied theology, and by whom he was licensed to preach is unknown. He came to East Jersey when only twenty-one years of age, his attention having been called to the vacancy in the Independent Church, by some of his wife's relatives. His marriage to Joanna Melyen must have taken place early in the spring of 1709, shortly after his call to Elizabeth. The ordination took place on September the 29th, 1709. He was thus placed in charge of a very important position. It was upon what might almost be called the outpost of civilization; there was no church beyond this to the westward. The field he occupied was a large one; beside the main settlement it included Woodruff's, Lyon's, Connecticut and William's Farms, and the straggling settlements beyond these at the crossing of the Woodbridge road, and on the present sites of Westfield and Scotch Plains. It was not long, however, before he took high rank in his profession, such was his industry and ability. His salary during these years was the munificent sum of £80 supplemented by "House, Glebe and perquisites of marriages." His connection with the Presbyterian Church probably dates from 1717; when he joined the Presbytery of Philadelphia, at their meeting in Woodbridge in April of that year. The church he represented was formally connected with the Synod for the first time in 1721, when he was chosen Moderator. At the next meeting he showed his power as a controversialist upon the subject of Ecclesiastical jurisdiction. His sermon on this subject was published, and it was his first appearance in print. The records of the Synod from this time on, show abundant evidence of his interest and activity in ecclesiastical matters and of the great confidence which was already placed in his judgment. In the following years he indulged in a discussion of the subject of ordination, which was carried on with great ability and to the discomfiture of his opponents. Later on his love of liberty and his fear of infringing the rights of the ministry, led him to oppose a measure the intention of which was to require the hearty assent of every minister to the Westminster Confession and Catechisms. While he cordially accepted these "symbols of faith," he was opposed to all imposition of creeds, of "human composure." While he was thus engaged, he did not neglect his duties as a citizen; and we find him casting his lot with his townsmen in defence of their homesteads as against the pretensions of the East Jersey proprietors.

Here he also showed himself an invaluable counsellor and organizer in defence of popular rights.

The period in which he lived and served the church was notable for the prevalence of scepticism. It was fashionable to decry both inspiration and revelation. The tendencies of the pulpit were to latitudinarianism in doctrine and practice, and Dickinson set himself to beat back the waves of error by preaching to his people, in a learned, discriminating and logical manner. In 1736 he was again engaged in a controversy upon Episcopacy, but in spite of all these exciting causes he was not inattentive to the spiritual wants of his people. He preached and worked most faithfully. Many of his sermons were printed and had a wide circulation.

In 1740, with Pemberton of New York and Burr of Newark, he was the means of attracting attention to the religious wants of the Indians, and Azariah Horton of Connecticut Farms was ordained to this work through his influence. Two years later David Brainerd was also engaged for this cause, and sent as a missionary to the Indians near New Lebanon, N. Y. In 1744, Brainerd was ordained at Newark for a "Mission at the forks of the Delaware," and found in Dickinson a devoted friend.

It was about this time that events so shaped themselves as to lead up to the founding of the College. The writer is indebted to Hatfield's History of Elizabeth for the interesting account of that event in our history which follows, as well as for the facts mentioned above.

Mr. Dickinson had long felt the necessity of a Collegiate Institution, more accessible than Harvard or Yale, for the colonies this side of New England. The course pursued by the authorities of Yale College, in denying to his young friend, David Brainerd, his degree, on account of a slight irregularity, and for whom he and Burr had both interceded in vain, determined him to establish, if possible, a College in New Jersey. Something had been done, already, by the friends of the Log College at Neshaminy, Pa. Mr. Dickinson, it is credibly reported, had for years taught a Classical School, or at least received young men into his house, to fit them for the ministry. The Rev. Jacob Green, of Hanover, and the Rev. Caleb Smith, of Orange, N. J., both of them, were his students. Incipient steps were taken by the Synod as early as 1739, to obtain aid from Great Britain, for this object; Mr. Dickinson being on the Committee for this purpose, "but the war breaking out" with Spain prevented it. At length, application was made, to John Hamilton, Esq., President of his Majesty's Council, and (by reason of the death, May 14, 1746, of Gov. Lewis Morris) Commander in Chief of the Province of New Jersey, for "a Charter to incorporate sundry persons to found a college." The application was successful, and it was granted, under the great seal of the Province, Oct. 22, 1746. Notice of the event and of the intentions of the Trustees was duly given, in the New York weekly *Post Boy*, No. 211, dated February 2, 174$\frac{6}{7}$, as follows:

Whereas a Charter with full and ample privileges, has been granted by his Majesty, under the Seal of the province of New Jersey, bearing date the 22d October, 1746, for erecting a College within the said Province, to Jonathan Dickinson, John Pierson, Ebenezer Pemberton and Aaron Burr, Ministers of the Gospel and some other Gentlemen as Trustees of the said College, by which Charter equal Liberties and Privileges are secured to every Denomination of Christians, any different religious Sentiments notwithstanding.

The said Trustees have therefore thought proper to inform the Public, that they design to open the said College the next spring; and to notify to any person or per-

sons who are qualified by preparatory Learning for Admission, that some time in May next at latest they may be there admitted to an academic education.

Subsequently, in No. 222, Apr. 22, 1747, notice is thus given :

This is to inform the Publick that the Trustees of the Colledge of New Jersey, have appointed the Reverend Mr. Jonathan Dickinson, PRESIDENT of the said Colledge; which will be opened the fourth Week in May next, at Elizabeth-town; At which Time and Place, all Persons suitably qualified, may be admitted to an Academic Education.

At the time specified the first Term of "the College of New Jersey" was opened at Mr. Dickinson's house, on the south side of the Old Rahway road, directly west of Race street. Mr. Caleb Smth, of Brookhaven, L. I., a graduate of Yale College in 1743, and now in the 24th year of his age, was employed as the first Tutor. Enos Ayres, (afterwards a Presbyterian minister at Blooming Grove, Orange Co., N. Y.), Benjamin Chestnut, (an Englishman, and subsequently of the Presbytery of New Brunswick), Hugh Henry, (afterwards of the Presbytery of New Castle), Israel Reed (shortly after the pastor of the Presbyterian Church at Bound Brook, N. J.), Richard Stockton, (of Princeton, the well known civilian), and Daniel Thane, (a Scotchman and subsequently pastor of the Church of Connecticut Farms in this town), were the first graduates of the Institution, and were all of them, doubtless, under the instruction of Mr. Dickinson and his Tutor, Caleb Smith; with others, perhaps, of the succeeding class.

In the midst of these useful and laborious employments, full of honors and of service, Mr. Dickinson's career on earth was brought to a close. He died of pleurisy, October 7, 1747, in the sixtieth year of his age. The Rev. Timothy Jones, of Morristown, visited him in his last illness, and found him fully prepared for the event. "Many days have passed between God and my soul, in which I have solemnly dedicated myself to Him, and I trust what I have committed unto Him, He is able to keep until that day." Such was his testimony, in death, to the Gospel in which he believed. On the occasion of his burial a sermon was preached by his old friend and neighbor, the Rev. John Pierson, of Woodbridge, which was afterwards published. The following notice of his death and burial appeared in the *New York Weekly Post Boy* of October 12, 1747 :—

ELIZABETHTOWN IN NEW JERSEY, Oct. 10.

On Wednesday Morning last, about four o'clock, died here of a pleuritic illness that eminently learned, faithful and pious Minister of the Gospel, and President of the College of New Jersey, the Rev. Mr. Jonathan Dickinson, in the sixtieth Year of his Age, who had been Pastor of the First Presbyterian Church in this Town for nearly forty Years, and was the Glory and Joy of it. In him conspicuously appeared those natural and acquired moral and spiritual Endowments, which constitute a truly excellent and valuable Man, a good Scholar, an eminent Divine and a serious, devout Christian. He was greatly adorned with the gifts and graces of his Heavenly Master, In the light whereof he appeared as a Star of superior Brightness and Influence in the Orb of the Church, which has sustained a great and unspeakable loss in his Death, he was of uncommon and very extensive usefulness. He boldly appeared in the defence of the great and important truths of our most holy Religion and the Gospel Doctrines of the free and sovereign Grace of God. He was a zealous promoter of godly Practice and godly Living, and a bright ornament to his Profession. In Times and cases of Difficulty he was a ready, wise and able counsellor. By his Death our infant College is deprived of the Benefit and Advantage of his superior Accomplishments, which afforded a favorable prospect of its future Flourishing and Prosperity under his inspection. His Remains were decently interred here Yesterday, when the Rev. Mr. Pierson, of Woodbridge, preached his funeral Sermon, and as he lived desired of all so never any Person in these parts died more lamented. Our Fathers where are they and the Prophets, do they live for ever?

This notice was probably written by the Rev. Mr. Pemberton, of New York, with whom Mr. Dickinson had been intimately associated, for years, in the defence of the the truth, and the promotion of the cause of Christ. The testimony thus borne to his great work was fully confirmed by all who knew him. President Edwards called him "the late learned and very excellent Mr. Jonathan Dickinson." The Rev. Dr. Bellamy called him "the great Mr. Dickinson." The Rev. Dr. John Erskine, of Edinburgh, said: "The British Isles have produced no such writers on divinity in the eighteenth century as Dickinson and Edwards." The Rev. David Austin, of this town, writing of him in 1793, gathers up the traditions of that day concerning him as follows:—

> There are those alive who testify that he was a most solemn, weighty and moving preacher—that he was a uniform advocate for the distinguishing doctrines of grace, as his writings prove—that he was industrious, indefatigable, and successful in his ministerial labors—as to his person, that it was manly—of full size; solemn and grave in his aspect, so that the wicked would seem to tremble in his presence.

His monument in the Presbyterian "Burying Ground" bears the following inscription:—

> Here lies y^e^ body of y^e^ Rev^d^
> Mr Jonathan Dickinson. Pastor
> of the first Presbyterian Church
> of Elizabeth Town. who Died Oct^r^
> y^e^ 7th 1747. Aetatis Suae 60.
>
> Deep was the Wound. O Death! and Vastly wide.
> When he resign'd his Useful breath and dy'd;
> Ye Sacred Tribe with pious Sorrows mourn.
> And drop a tear at your great Patron's Urn!
> Conceal'd a moment, from our longing Eyes,
> Beneath this Stone his mortal Body lies;
> Happy the Spirit lives, and will, we trust,
> In Bliss associate with his precious Dust.

SOME OF DR. McCOSH'S SERVICES TO PHILOSOPHY.

By A. T. ORMOND.

The real importance of Dr. McCosh's work in philosophy was to a great extent obscured during his life by a certain lack of appreciation of which he occasionally complained. "They won't give me a hearing," he would say somewhat mournfully. And then he would cheer up under the assuring conviction that Realism, as it was the first, would also be the final, philosophy. Dr. McCosh's position in philosophy suffered during his life from a kind of reaction against the Scottish school, which had set in with Mill's destructive criticism of Hamilton. It was also materially affected by the strong movement in the direction of evolutionary empiricism of which Herbert Spencer was the exponent and leader. The dogmatic and positive tone of Dr. McCosh himself had doubtless something to do with the tendency to undervalue his work.

There are other circumstances which must not be overlooked in estimating the value of Dr. McCosh's philosophy. It scarcely ever happens that a man is the best judge of his own work or that the things on which he puts the greatest stress possess the most permanent value. Much of Dr. McCosh's work is of a transitional character. His whole attitude toward evolution, for example, is that of a transitional thinker who, although hospitable to the new, maintains, on the whole, the old points of view. Dr. McCosh, it may be said briefly, accepted evolution provisionally, but he could scarcely be called an evolution thinker. Again, it is true of Dr. McCosh as of most other men, that the principle and content of his work must be distinguished from the form in which he embodied it. Generally it is a failure

to distinguish the principle from the accidental form that constitutes one of the greatest limitations of any thinker. This is certainly true of Dr. McCosh. The essence of all his doctrines was so associated in his mind with a certain mode of conceiving and stating them as to make the form seem essential to the doctrine. An example of this is his theory of Natural Realism in the sphere of perception, in which a certain mode of apprehending the object was deemed essential to the assertion of reality itself.

Leaving out of view, however, accidental features and elements of a merely transitional character, it seems to me that Dr. McCosh has contributed several elements of distinct value to the thinking of his time. One of these is to be found in his treatment of the Intuitions. At the time Dr. McCosh first became interested in the problems of speculation, Intuitionism had suffered a kind of eclipse in the writings of Sir William Hamilton, whose attempt to combine Scottish Epistemology with Kantian Metaphysics had resulted in a purely negative theory of such intuitive principles, for example, as causality. Dr. McCosh harked back to Reid and reasserted the pure Scottish position against the unnatural hybrid of the Hamiltonian metaphysics. But he is not to be regarded as simply a reasserter of Reid. His wide acquaintance with the history of philosophy, as well as his keener faculty of criticism, led to a more careful and discriminating analysis of the intuitive principles of the mind as well as to a more philosophical statement of them. He also connected them with the three epistemological functions of cognition, judgment and belief, in such a way as to bring them into closer relations with experience, and by recognizing a distinction between their cognitive and rational forms, to admit the agency of an empirical process in their passage from the singular to the more general stage of their apprehension. Of course, where the reality of intuitive principles is denied Dr. McCosh's interpretation of them will not be appreciated. But inasmuch as the affirmation of native elements in some form is likely to continue, the contribution of Dr. McCosh to Intuitional thinking is likely to be one of permanent value.

The one point on which Dr. McCosh was most strenuous was that of Realism. He had a kind of *phobia* of all idealistic or phenomenal theories. This rendered him somewhat unduly impatient of these theories, and they sometimes received scant justice at his hands. But whatever his failings as a critic, there was no ambiguity about his own point of view. He was the doughtiest kind of a realist, ready at all times to break a lance in defense of his belief. Here as elsewhere, in estimating the value of Dr. McCosh's work, it is necessary to observe the distinction between the principle and the form of his doctrine. Perhaps few thinkers at present would accept the unmodified form of his realism. But the positions he had most at heart, namely, that philosophy must start with reality if it would end with it, and that philosophy misses its aim if it misses reality and stops in the negations of Positivism or Kantism; these are positions which a very wide school of thinkers have very much at heart. Dr. McCosh's realism is a tonic which invigorates the spirit that comes into contact with it and indisposes it to any sort of indolent acquiescence in a negative creed.

In harking back to Reid Dr. McCosh was recognizing intellectual kinship in more ways than one. The spirit of Reid, while pretty positive and dogmatic, was also inductive and observational. Reid hated speculation, and would not employ it except at the behest of practical needs. Dr. McCosh was a man of kindred spirit. His

distrust of speculation amounted at times, I think, to a positive weakness. But his shrewd common sense, combined with a genius for observation and an intense love of fact, constituted perhaps the most marked quality of his mind. It has kept his work fresh and interesting, packed his books with new and interesting facts and shrewd observations and has made them rich treasure-houses for those who come after him. This is especially true in his Psychological work. Here, where on account of the rapid advance of Psychology in both method and content, the results of his generation of workers are fast becoming inadequate to the new demands; it ought not to be forgotten that Dr. McCosh was almost the pioneer of a new departure in Psychology in this country; that his was the most potent voice in the advocacy of that marriage of the old science of introspection with Physiology, out of which the new Physiological Psychology arose; that his example was most potent in advocating the substitution of an observational for a closet Psychology, and that while he contributed little to experimental results, the influence of his spirit and teaching was strongly favorable to them.

Perhaps in the end it will be seen that Dr. McCosh rendered his most lasting service in the sphere of religious thought. In view of the tendency in many quarters to divorce Philosophy from Religion and insist that philosophy has no legitimate interest in the problems of religion, the attitude of Dr. McCosh is reassuring. That the problems of religion are the supreme and final questions in philosophy, and that no philosophy is adequate that is unable to find some rational justification, at least, for a Theistic view of the world; these were points on which he insisted as cardinal. Dr. McCosh was a profound thinker who saw clearly the necessity of a metaphysical ground-work of both Morals and Religion. His own Theistic conviction was at all times firm and unclouded. But aside from the form of his own individual beliefs his insistence on the questions of God's existence and man's relation to Him as the vitalest issues of philosophy, contains an important lesson for the time.

In this connection also, his relation to the Evolution theory is noteworthy. It was in the religious aspect of this theory, and especially its bearing on Theism, that he was most vitally interested. He early saw that a Theistic conception of development was possible, and this prevented him from adopting the view of its extreme opponents, and condemning it as necessarily atheistic and irreligious. He maintained the possibility of conceiving evolution from a Theistic basis as a feature of the Method of Divine Government, and this led him to take a hospitable attitude toward the evolution idea, while at the same time it enabled him to become the most formidable critic of evolution in its really atheistic and irreligious forms. This treatment of the problem of evolution by a religious thinker possesses more than a transitional value. It correctly embodies, I think, the wisest and most philosophical attitude which a religious mind can take toward the advances of science during that period of uncertainty which ordinarily precedes the final adjustment of the new into the frame-work of established truth.

On the question of Dr. McCosh's originality, I think this may be said. While it is true that he has added no distinctively new idea to philosophy, yet his work possesses originality in that it not only responded to the demands of the time, but also bears the stamp of the author's striking and powerful individuality. The form of Dr. McCosh's discussions is always fresh, characteristic and

original. He was an original worker in that his work bore the stamp of his time and personality and constituted part and parcel of the living energy of his generation.

SESQUICENTENNIAL COMMITTEES.

Inasmuch as no complete list of the composition of the committees appointed in connection with the approaching Sesquicentennial Celebration has yet been published, the following lists are here appended for the information of alumni and friends of the college. These lists are complete up to January, 1896. Three committees have been appointed; the first, a committee of members of the Board of Trustees, on the proposed Change of Corporate Title; the second a Committee on Endowment, consisting of members of the Trustees, Faculty and Alumni, and the third a Committee on the Sesquicentennial Celebration itself, consisting of members of the Trustees, Faculty and Alumni. The organization and personnel of these committees is given below.

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Henry M. Alexander, LL.D., 120 Broadway, New York City.
Hon. Edward T. Green, LL.D., Trenton, New Jersey.
The President of the College, Princeton, New Jersey.

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M. Taylor Pyne, LL.B., A.M., 52 Wall St., New York City.
Cyrus H. McCormick, A.M., Wabash & Congress, Chicago, Ill.
John J. McCook, LL.D., 120 Broadway, New York City.
J. Bayard Henry, A.M., Drexel Building, Philadelphia, Pa.

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The Dean of the Faculty.
Prof. John T. Duffield,
Prof. William M. Sloane,
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Adrian H. Joline, A.M., 54 Wall St., New York City.
Charles Scribner, A.M., 155 Fifth Ave., New York City.
C. C. Cuyler, A.M., 44 Pine St., New York City.
S. B. Huey, A.M., Drexel Building, Philadelphia, Pa.
John D. Davis, A.M., 421 Olive St., St. Louis, Mo.
James Laughlin, Jr., A.M., Pittsburgh, Pa.
W. W. Lawrence, A.M., Water St., Pittsburgh, Pa.

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Cyrus H. McCormick, A.M.
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The President of the College.
Prof. William M. Sloane.
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120 Broadway, New York City.
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—o—

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Mr. T. H. Powers Sailer,
Mr. C. Ledyard Blair,
Mr. Henry M. Alexander, Jr.
Mr. Henry W. Green,
Mr. Irving Brokaw,
Mr. John W. Garrett,

THE STAND AT PRINCETON.

From a Lay of the Revolution, an unpublished Poem by W. W. LORD, Former Boudinot Fellow of Princeton.

[The author of the following poem, the Rev. William Wilberforce Lord, D.D., when a student in Princeton Theological Seminary, in 1844, published a volume of poems which were received with marked favor—among other expressions of high appreciation a complimentary notice by the poet Wordsworth. Princeton's distinguished Professor of Mathematics, Albert B. Dod, was so impressed with the author's ability that through his influence a special Fellowship was founded at the College for Mr. Lord. As the incumbent he gave a course of lectures on English Literature, which was largely attended by Professors as well as students of both the College and Seminary. Shortly after Mr. Lord, with his most intimate Seminary friend, Abram Newkirk Littlejohn, the present Bishop of Long Island, left the Presbyterian Church and entered the Episcopal Ministry. Mr. Lord subsequently published an extended poem of rare merit entitled "Christ in Hades," also "Andrè, a Tragedy." The following poem has been somewhat abridged for publication in THE BULLETIN.—J. T. D.]

Harp that has long in silence slept,
Hast thou the shaping spirit kept
To tell how one great deed imparts
Its impulse to a thousand hearts?
Or what a heaven-born hero dares,
Defiant, while his soul despairs?
But pause: of what grand tale retold
Seems this the echo, onward rolled?
Of heroes in their dust, what forms,
Warlike but calm, like men who long
Have dwelt in regions above storms,
Called by the poet's magic song,
Or touched by hoary History's wand,
Start forth, as if by Glory's hand
Reclaimed from death!—the Attic king
Who to his subjects, doomed, in strife,

Ignoble victory to bring,
Fighting, put off his crown and life:
The Jarl, whose banner bore, foretold,
Death, wrapped with victory in its fold;
The youth, who held the bridge for Rome;
The Swiss, who made his Alpine home
Scene of a drama beyond art
For power and pity, and his part
A terror to the human heart—
Stern archer, who before the eyes
Of gloomy tyrants stands forever,
While each unerring shaft that flies
Sings of its brother in the quiver!
And, in the same wild eyrie born,
And with his eagle soul of scorn,
The knight, who rode on victory's crest,
Borne by the spears that in his breast
He gathered to make Freedom way:
Heroes! but not the heroes they,
Realms wasted by the sword and flame
Condemn to everlasting fame:
Greek, Roman, Goth—in each we see
The same great form, superb and free,
Of victim, vowed to Victory!

And though in fables misty light
It gains in stature to the sight,
Was never form to that more true
Than this, which consecrates anew
The man, in whom mankind has known
Its greatest, by the tokens shown;
But never on his brow serene
Shadow of martyr's crown has seen.
Yet, doubt me not; without the name
Martyrs have lived, in thought and will
Like those whom death gave palms of fame;
And in the same grand circuit still
All things come round, from age to age—
So said the King; so reads the page;
Men but bequeath their heritage;
And heroes live, and men are free
By the soul's grand heredity.
And in what country or what day,
Be faith or faction what it may,
Lived hero, sung to Freedom's lyre,
But had—though not upon the roll
Of men who died by axe or fire—
A martyr's faith, a martyr's soul?

And this the tale: no fiction spun
On Fairy wheel in days of old,
But what in Freedom's war was done,
And brave Hugh Mercer saw and told—
Borne from the field and staying death
By that last use he had for breath—
And gave to those who leave to me
The right its chronicler to be,
And hero's tale of hero give
Place in a nation's narrative.

'Twas in a crisis of the strife
Of infant Freedom for her life,
Threatened by Britain's glaive, in scorn
Of birthright and of title torn
From monarchs by the iron will
Of men whose dauntless spirit still
Wrought in wide lands beyond the sea
The giant tasks of liberty.
Their voice her sleeping spirit woke;
A Sidney in her Adams spoke;
As finished, by a sculptor bold,
From block defaced or broken mould,
The work a master's hand begun,
So, Hampden, thine by Washington!

But little for such service then
He thought to have the thanks of men,
Or of a country that in fame
Snatched from a continent its name;
And, as its first-born nation's right,
Will bear forever on her shield
America, although in spite
Of older claim and larger field.

Far on the land, the invader's power
Impending cast a shadow grave;
And fear grew bold and croaked the hour
Of coward triumph o'er the brave.
Forced backward by an iron hand,
And leaving naked all the land
From Blue Ridge to Atlantic strand,
On the Colonial arms a blight
Fell, like the rust that came by night
On blade and bayonet. Backward still,
Still Southward, fell the patriot force.
What courage, or what strength of will
Can fill the ranks of foot and horse,
Feed, clothe, inspire a starving host,
Half conscious that their cause is lost?
Thus by the fireside said, in thought,
Brave men: the women prayed and wrought—
Then through the Delaware's crashing ice
The unexpected hero came,
To cast again the iron dice,
For life or death, in war's grim game.

As oft, when his predestined track,
Re-entering, the sun turns back
On the stern realms of cold and frosts,
A wave of summer smites the hosts
Of icy vapor into rack

Of rain and mist, and drives the pack
Of winter's tyrants from their hold,
So back on the invaders rolled
The tide of battle, and before
The Colonies' ragged columns bore
The British and their Hessian corps.

O, sweeter than the voice of fame,
  Or vows when parted lovers meet,
Is glory snatched from threatened shame,
  And victory following on defeat!
Nor then divined they that their feet,
  Ill-shod and wounded in the march,
Would, later, press the flowery street,
  And under the triumphal arch
Of Trenton's civic pageant pass:
Nor yet how few the feet, alas,
That soil again would proudly tread—
But sadly, for it held the dead
Who, sleeping there in glory's bed,
Through summer's heat and winter's snow,
Shall never of their victory know!

And now, though winners of the day,
Well knew they that before them lay
An army stubborn as the best
That ever yet, in east or west,
Held field or fortress: for the rest,
Briton or Teuton, theirs the race
Of which a Roman who in face
Of fiercest battle met the Franks,
Said, there were red cheeks in their ranks.
And the redcoats—beneath which aye
A red heart beat—no older day
Of shining mail or wolf's rough fell
Their hated wearers could excel
In valor's evidence; as knew
The hearts to touch of kindred true
That beat beneath the buff and blue.

Nor lacked they proof: from day to day
Skirmish and feint renewed the fray;
Till, in superior force of men
And ordnance, confident again,
The royal leader throws in vain
His gage of battle on the plain.
Thus stood they fronted: until—blind.
Outmarched Cornwallis left behind—
On foemen, better matched in might,
The great Virginian moved, by night,
So swiftly that the morning light
Still deeper with the hue of blood
  Reddening the Royal colors showed
The hireling Hessians, where they stood,
  Holding, in force, the Northern road.

On Princeton's heights, their ordnance manned
By men with mastered eye and hand,
Stood silent; till the dusky wreath
Of marching infantry beneath
Came, winding upward, where, to sight,
In battery on the nearest height,
The cannon stand against the sky:
Then thunder!—but the death-bolt high
Above them crashed, and hurtled by.
Forward! and half the extent they gain,
Of the broad slope from hill to plain,
When falls again the iron rain,
And pales the best, the boldest daunts.
The column halts: "Close, and advance,"
Said Washington, "Disarm at once
That height!"—no movement, no response;
Wavered the Pennsylvania line;
"Great God," he said, "my life is thine!"
Few heard him, but each eye was strained,
When moving to the front, he reined
His charger in, and, wheeling, right
  Before the battery held him checked;
Like some grand statue in their sight
  He sat there silent, calm, erect.
Confronting death: one moments's hush,
Then with a whirlwind's sudden rush,
Before the battery once more
Can shake the summit with its roar,
Right up the hill, upon the run,
They charged, and captured every gun
On Princeton's heights: the day was won.

Suppose coincidence, or result;
Give the old reason, "*Deus vult;*"
The fact is certain: the twin days
Trenton and Princeton, in their blaze
Of native valor, mark the turn
In Freedom's fortunes; brighter burn
Her struggling stars; though clouds still lower,
No shrinking from the front of power!
Doubt and suspense, but not despair:
Lion and whelp their forest lair
Disputed still, but this, grown bold,
Feared not the giant, grim and old.
Boys marched to battle, dotards planned
High strategy, to save the land.
Women changed hearts with men, and one
Stood firm to an abandoned gun,
Refilled with death its iron bore
Unflinching, waked its silent roar,
And lives in fame. Through hopes and fears
The war crept on, and tracked the years
With bloody footprints, till at last—
  Grandest of tyrannies overturned,
And noblest of free leagues surpassed—

The sun of Yorktown rose, and burned
In glory on the astral wreath
Of federal commonwealths beneath
The New World's banner, and—the sun
Of later fields for freedom won
Foretelling—with reflected glance
Shone on the chivalrous arms of France.

But grander is the form that stands
Under the Princeton battery's frown
Than that which takes from Britain's hands
The sword surrendered by the Crown,
And deathless title to renown.

To thee, old Nassau's honored Hall
That, erstwhile, showed for many a day
The dint and scar of iron ball,
Duteous, I dedicate my lay.
No laurel from thy wreath of fame
It plucks, to tell how, though in war,
The Father of his country came,
Led by his often clouded star,
To wrest from the invader's hand
The home of Stockton, and the boon
Of new hope offer to that grand
Unwavering Scot, gray Witherspoon.

* * * * * *

SUMMARIES OF PAPERS READ AND PUBLISHED.

AN IMPROVED CALORIMETER FOR THE APPLICATION OF THE METHOD OF MIXTURES.

By FRANK A. WATERMAN.

The determination of the specific heat of solids by the Method of Mixtures, as employed by Regnault, is especially subject to errors arising from the determination of the radiation correction. For the purpose of avoiding this source of error Mr. M. N. Hesehus* has suggested that the calorimeter cup be introduced into the bulb of an air thermometer and maintained at a constant temperature by the introduction of a sufficient amount of cold water, of known temperature, immediately after the introduction of the heated solid. By this means both the radiation correction and the water equivalent of the calorimeter cup are avoided. The heat received by the cold water being equal to that given out by the heated body, the following simple equation may be used:

$$MS\ (T-\theta)=ms\ (\theta-t)$$

in which

M = mass of substance, the specific heat of which is to be determined.

m = mass of cool water introduced into calorimeter cup.

T = temperature of heated body.

θ = initial temperature of calorimeter cup.

t = temperature of cool water introduced into calorimeter cup.

s = mean specific heat of water at temperature used.

S = specific heat sought.

From the above equation we have

$$S=\frac{ms\ (\theta-t)}{M\ (T-\theta)}$$

the working equation used.

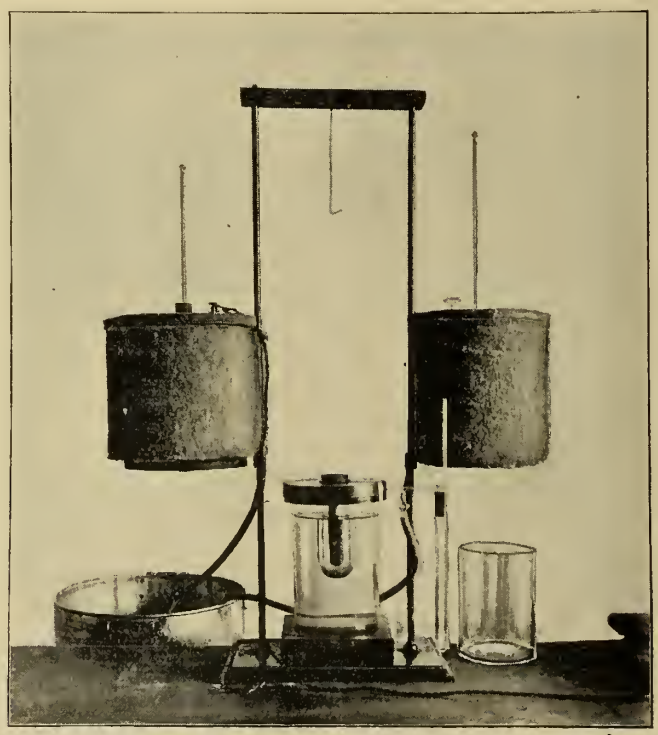
The results obtained by this method, as submitted by Mr. Hesehus, do not appear to be as accurate, however, as those obtained by the Method of Mixtures as practiced by Regnault. The ten determinations given of the specific heat of brass varied from .0821 to .0969 or, omitting the result .0821 which was apparently erroneous, nine determinations varied from .0908 to .0969, the probable error of the mean of the whole being much greater than is usual in the case of a similar series of results obtained by Regnault's method. As the above method appeared to be a desirable one for some work in hand I have endeavored to perfect a calorimeter by means of which it might be applied with greater accuracy. The form of apparatus which I have devised has proven very satisfactory after repeated

* *Journal de la Société Physico-chemique Russe*, Nov. 1887. *Journal de Physique*, tom. vii, p. 489, 1888.

trials, as is shown by the results here submitted. It consists essentially of the following parts:

A glass jar, which supports, by a wooden cover, the bulb of a glass air thermometer, the manometric tube of which, in the form of a capillary U tube, is supported in a vertical position. The glass jar is kept nearly full of water for the purpose of maintaining the thermometer bulb constantly at room temperature and preventing any sudden variation of temperature due to air currents. For the purpose of increasing the sensitiveness of the thermometer the liquid selected was one of low density, and kerosene, of specific gravity approximately .8, was taken. The air thermometer thus constructed proved very sensitive and a change in the temperature of the calorimeter cup of .01°C, was clearly shown by an elevation of the manometric column.

The calorimeter cup is made in the form of a thin tube of silver, of the general form of a test tube, cemented to a rubber stopper which may be inserted air tight into the thermometer bulb. This device was first used, but the calorimeter as now made has an air tight connection at this part similar to that used on the calorimeter for the Method of Cooling as usually applied. Silver was selected as the material used for the cup on account of its high conductivity for heat, which causes the temperature of the cup to quickly become that of its contents.



The water cooler and dropper is supported upon a vertical rod in such a manner that it may be quickly turned about the rod as an axis and may deliver water directly to the calorimeter cup.

The cooler consists of an ice receiver, covered with heavy felt, within which the water receiver is placed. The water re-

ceiver is made in the form of an inverted cone of copper. This form has been found most satisfactory for maintaining the water at a constant temperature, as the ice, resting upon the sides of the water receiver, can not melt away from them leaving an intervening air space.

The water dropper consists of a syphon within the longer arm of which a thermometer is introduced, the bulb of which is kept very near the small orifice from which the water drops when a stop cock is opened. Thus no barrier is interposed at any time between the thermometer bulb and the point of delivery of the cold water. A glass guard tube protects the dropping water from air currents.

An electric heater is supported upon a second vertical rod and may be turned about the rod as an axis until the heater is directly over the calorimeter cup, allowing the heated body to be transferred directly to the cup. The heater, which is somewhat similar in form to that designed by Prof. Henry Crew,* consists of a copper tube about which is wound a heating coil of German silver wire, insulated from the tube by narrow strips of asbestos paper. This is inclosed within a larger tube and all is inserted within an ice jacket, the space between the larger tube and the ice jacket being packed with cotton to prevent convection currents of air. The temperature of the outer wall remaining constantly that of the melting ice, the flow of heat remains constant between the inner and outer walls as long as heat is uniformly supplied to the inner chamber. This is readily maintained by a constant electric current supplied to the heating coil from a storage battery of sufficient capacity having a variable resistance in its circuit. The temperature of the heater is readily maintained constant within .1°C, for five or six hours, at any temperature desired for the conditions of the work in hand. The thermometer for the determination of the temperature of the heated solid is supported by a cork inserted in the upper end of the inner tube. The lower end of the tube is closed by a cork which is removed to allow the solid to pass into the calorimeter cup when heated.

The method of making a determination of the specific heat of a metal by means of this calorimeter is as follows:

The metal may be suspended in the heater in small fragments contained in a basket of fine wire gauze of known specific heat, as employed by Regnault, or, if in the form of sheet metal or fine wire, may be suspended in contact with the thermometer bulb by a thread of known weight. The metal is then maintained at the desired temperature for a sufficient time.

The calorimeter cup is then withdrawn from the bulb of the air thermometer, pure water at room temperature is introduced in sufficient quantity to cover the metal used, and the whole is carefully weighed. The cup is then placed in position in the bulb of the air thermometer. The initial temperature of the cup, which remains at room temperature, is then taken by means of a thermometer suspended within the cup, having the bulb in contact with the side of the cup but not touching the water. Water is allowed to drop from the water dropper and its thermometer is read as soon as its temperature becomes constant. This occurs after a few drops have fallen. The manometric column is then brought to the same level in each arm of the U tube. A strip of white cardboard attached to the U tube, with a horizontal ink line back of the level surface of the manometric liquid, renders the position of the column plainly visible.

The heater is then turned around into position and the heated metal quickly introduced into the cup. The heater is then turned back and the water dropper quick-

* *Philosophical Magazine*, Vol. 33, 5th series, 1892.

ly turned into position and water allowed to drop into the cup, at first rapidly, then more slowly until the manometric column remains at its original level, indicating that the initial temperature of the cup has been maintained. A little practice in the manipulation of the calorimeter enables the operator to keep the cup practically at its initial temperature throughout each determination, thus obviating the use of radiation correction and "water equivalent" of the cup. The falling of the cold water from the water dropper into the tube shaped cup also serves to agitate the water in the cup and keeps its temperature uniform without the use of a stirrer. The cup and its contents are then removed from the bulb of the air thermometer and weighed. The weight thus obtained, minus the initial weight of the cup, water contained and weight of metal used, gives the weight of cold water added.

The necessary operations briefly stated are thus:

The heating and the determination of the temperature of a body of known weight. Weighing of cup containing a suitable quantity of water.

Determination of initial temperature of cup. Introduction of the heated body into the cup, quickly followed by the introduction of a quantity of cool water sufficient to maintain the initial temperature of the cup; the temperature of the cool water being observed during this operation.

Final weight of the cup and its contents determined and the weight of cool water added determined from data obtained. Calculation of result by use of the equation

$$S = \frac{ms\,(\theta - t)}{M\,(T - \theta)}$$

The results obtained by use of this calorimeter, which are here given, are but a summary of some trial determinations made from time to time as the apparatus was being improved. As chemically pure metals were not at hand, the results obtained are submitted simply for the illustration of the accuracy with which determinations may be made, and are not considered to be exact values of the specific heats of pure metals. In the calculation of results, s, the specific heat of the water used, was taken as unity. The three thermometers used for the heater, cup and water cooler were made by Mr. H. J. Green, of Brooklyn, N. Y., and were standardized by comparison with Yale Observatory Standard No. 59, made by Tonnelot of Paris and standardized at the Yale College Observatory by Mr. Leonard Waldo. All weighings were made upon a balance sensitive to .1 milligramme under the given load.

Cadmium—as supplied for chemical use, purity unknown; cast in the form of a thin cylinder.

M	t	θ	T	m	S
13.2481g	.30°	11.12°	85.60°	5.0425g	.05529
"	2.51	15.00	93.38	4.601	.05534
"	.42	24.15	100.10	2.3675	.05583

No mean taken on account of different temperatures used.

Copper—from Lake Superior, 99.9% pure. Two pieces taken from a thin bar of drawn metal.

M	t	θ	T	m	S
10.9322g	.19°	23.39°	100.0	3.4204g	.09475
"	.30	22.42	100.2	3.6403	.09470
23.6625	.30	21.51	100.0	8.2960	.09474
"	.25	23.62	99.8	7.3020	.09467
					.09471

Gold—nearly pure; in the form of a thin bar.

M	t	θ	T	m	S
17.8292g	.20°	24.00°	100.00°	1.7456g	.03066
"	.25	24.41	100.00°	1.7101	.03065
"	.35	23.45	99.95°	1.8153	.03074
					.03068

Alloy—melting point 70°C. Bismuth 4 parts, Cadmium 1 part, Lead 2 parts, Tin

1 part. Metals used were supplied for chemical use; purity unknown.

M	t	θ	T	m	S
16.108g	2.53°	21.94°	60.66°	1.1475g	.03571
"	3.12	21.76	60.42	1.1913	.03566
"	1.60	21.66	59.67	1.0875	.03563
"	2.51	21.93	59.45	1.1080	.03560
"	2.93	21.08	60.26	1.2390	.03563
					.03565

Zinc—as supplied for chemical use; purity unknown; in the form of a thin cast bar.

M	t	θ	T	m	S
20.3805g	.20°	23.40°	99.9°	6.4160g	.09547
"	.20	23.50	100.0	6.3860	.09544
"	.27	23.85	100.2	6.3017	.09547
					.09547

This method may readily be extended over a considerable range of calorimetric work. The electric heater permits the heating of the body under investigation to any temperature ordinarily desired. The specific heat of a liquid may be determined by inclosing it in a suitable vessel, the constants of which have previously been determined. Some liquid other than water may be found preferable for special work and may readily be used in the cup and cooler. Aniline, the use of which is advocated by Mr. E. H. Griffiths,* has a smaller capacity for heat and a higher boiling point than water. It would therefore increase the sensitiveness of the calorimeter in measuring small quantities of heat and the range of temperatures throughout which an investigation might be carried.

This calorimeter, as now made, enables the experimenter, of ordinary skill in manipulation, to obtain results which are comparable, in accuracy and consistency, with those obtained by any calorimeter in use.

For this reason it is well calculated for student use, as well as for research work, for which its wide range of application makes it especially suitable.

[Abstract of a paper published in the London, Edinburgh and Dublin *Philosophical Magazine*, Vol. 40, November, 1895.]

* *Philosophical Magazine*, Vol. 39, page 47, 1895.

ON THE EXISTENCE OF THE SULPHOXYANTIMONIATES.

By LEROY W. McCAY.

The recent appearance of Dr. Bohuslav Brauner's paper on the action of hydrogen sulphide on solutions of antimonic acid* induces me to publish the following preliminary notice respecting my own work on the same subject:

RAMMELSBERG'S SALT.

In the year 1841, in an article upon the sulphantimoniates and sulpharseniates,† Rammelsberg describes a remarkable salt which he obtained by acting on pentasulphide of antimony with cold, moderately concentrated potassium hydroxide. The potassium metantimoniate which separated out as a heavy white powder on treating the pentasulphide of antimony with potassium hydroxide was removed by filtration, and the filtrate concentrated by evaporation. The hot liquid thus obtained yielded on cooling long, needle-shaped crystals of a colorless salt which bore no resemblance to the ordinary potassium sulphantimoniate. The following is Rammelsberg's analysis:

Potassium,	23.400‡ %
Antimony,	37.803 "
Sulphur,	18.195 "
Oxygen,	7.298 "
Water,	13.304 "
	100.000

Rammelsberg regarded the compound as a double salt, and wrote its formula $2(K_3SbS_4)+9H_2O+2(KSbO_3)+H_2O$.

A salt having such a composition would, according to Rammelsberg, require:

Potassium,	23.002 %
Antimony,	37.863 "

*Transactions of the Chemical Society, 1895, p. 527.

†Ann. d. Phy. u. Chem., 32, p. 193.

‡His second determination of potassium. I take this figure rather than the other (22.60) because it makes the results found agree better with those demanded by theory.

Sulphur,	18.889 %
Oxygen,	7.043 "
Water,	13.203 "
	100.000

It will be observed that these percentages agree remarkably well with those found.

The peculiar composition of this salt did not fail to surprise Rammelsberg. In discussing the matter he states definitely that it is, with one exception,* the only compound of the kind known to the chemist.

The results of my study of the action of sulphuretted hydrogen on solutions of antimonic acid, a matter which has engaged my attention off and on ever since the appearance of my paper on the action of sulphuretted hydrogen on solutions of arsenic acid,† have led me to believe that the salts of sulphoxyantimonic acid are capable of existing. I have felt convinced for a number of years that the formation of the mixture of antimony pentasulphide, antimony trisulphide and sulphur which, under ordinary circumstances, is always formed when sulphuretted hydrogen is permitted to bubble through acidified solutions of antimonic acid, can be explained in a manner perfectly analogous to that in which the mixture of arsenic pentasulphide, arsenic trisulphide and sulphur is accounted for when sulphuretted hydrogen acts on acidified solutions of arsenic acid. A great deal of work, however, satisfied me that it would be impossible to solve the problem by merely considering the products formed during the interaction of the sulphuretted hydrogen and antimonic acid under different circumstances, consequently I decided to make a number of experiments with the view of settling definitely whether the salts of sulphoxantimonic acid could be prepared.* By examining into their properties and reactions I hoped to obtain an insight into the mechanism of the changes which, until recently,† have been fully as mysterious as those relating to the interaction of sulphuretted hydrogen and arsenic acid used to be.

It was while endeavoring to prepare the barium salt of monosulphoxyantimonic acid that I ran across the article of Rammelsberg above referred to. A mere glance at the formula proposed by him for his double salt persuaded me that it was one of the suspected sulphoxyantimoniates—not the particular one I was looking for, but still a sulphoxy-compound. It will be seen that the dualistic formula $2(K_3 Sb S_4) + 9 H_2 O + 2(K Sb O_3) + H_2 O$ can be written $K_4 Sb_2 O_3 . S_4 + 5 H_2 O$—*i. e.*, we can regard the compound as a sulphoxy-salt of the pyro-form. Using the more recent atomic weight determinations‡ in the calculation, a salt of this composition would require:

K_4	23.59 %
Sb_2	36.27 "
O_3	7.24 "
S_4	19.33 "
$5H_2O$	13.57 "
	100.00

These figures are practically the same as those found by Rammelsberg. But another possibility suggests itself. The Rammelsberg salt can be regarded as a secondary potassium orthodisulphoxyantimoniate—$K_2 H Sb O_2 . S_2 + 2 H_2 O$. Since the days of dualism are about past, and our modern conceptions concerning the make up of double salts are quite different from what they were when Rammels-

*American Chemical Journal, Vol. x, No. 6.

†Berzelius has described a salt of wolfram to which he assigns the formula, $K_2 W S_4 + K_2 W O_4$. Traité de Chemie, 2 ed., III, p. 197.

*According to Feit and Kubierschky the sulphoxantimoniates are incapable of existing at ordinary temperatures. Ber., 1888, 21, 1660.

†Brauner. Loc. cit.

‡Classen: Quant. Analy. Chemie., 3te., Aufl. Also Sb = 120.

berg published his article on the sulph-antimoniates and sulpharseniates the ideas here thrown out would seem to be perfectly reasonable.

PREPARATION OF THE SALT.

The matter is one of intense interest, and in as much as a proof of the existence of the sulphoxyantimoniates would, as before intimated, serve to cast a great deal of light upon, if not completely account for, the peculiar conduct of antimonic acid when treated with sulphuretted hydrogen, it seemed wise to repeat Rammelsberg's experiments and examine the salt in detail. A revision of his work appears all the more desirable when we consider the fact that over one half a century has elapsed since the attention of the chemical world was called to the existence of the salt.

I. Pentasulphide of antimony, prepared by precipitating a solution of Schlippe's salt with sulphuric acid, was washed, dried and treated with a sufficient amount of cold, moderately concentrated potassium hydroxide to produce complete decomposition. After standing about twenty-four hours the dirty white precipitate of potassium metantimoniate was filtered off and the filtrate, in a porcelain dish, evaporated on the water bath until signs of crystallization were observed. The source of heat was now removed, the dish with its contents placed in a cool spot and the crystallization allowed to proceed. In the course of twelve hours there had separated out a number of semi-spherical aggregates made up of needle-shaped crystals grouped in concentric radiating clustres. The diameters of some of the aggregates were fully one centimetre. The mother liquor was poured off, and the crystals freed as far as possible from that adhering to them by first bringing them into a large Gooch crucible made of platinum, joining this up in the ordinary way with the water pump and sucking them until all spraying at the bottom of the crucible had ceased. They were then pressed again and again between folds of filter paper until they no longer stained the same and finally dried in a vacuum over caustic lime. They were of a straw yellow color. The following are the results of my analyses of the salt:

Potassium,	23.10	——	——
Antimony,	36.97	36.60	——
Oxygen,	——	——	——
Sulphur,	——	18.64	——
Water,	——	——	13.79

These percentages are to all intents and purposes the same as those found by Rammelsberg.

The salt kept for a long time in a vacuum over caustic lime without undergoing decomposition, but in the air, especially when this was moist, the crystals soon became sugar-brown, then red and finally crimson. However, they did not deliquesce or crumble to pieces, but remained apparently dry and, as far as form was concerned, intact. When freshly prepared the salt was completely soluble in water, but when it had become reddish there was always a small residue which refused to dissolve. This residue appeared to be sulphide of antimony.

II. In order to obtain a larger quantity of the salt I treated 64 grams of antimony pentasulphide (Golden Sulphur—Merck & Co.), in an Erlenmeyer flask of about 650 cm^3 capacity, with 46 grams of potassium hydroxide (87.4 % K O H) dissolved in 250 cm^3 of water. The flask was corked, violently shaken every now and then, and allowed to stand in a cool place for twenty-four hours. The potassium metantimoniate was filtered off, and the reddish filtrate evaporated in a large porcelain dish on the water bath until signs of crystallization appeared. The source of heat was now removed, and the crystallization allowed to proceed on the bath. The yield here was much larger than in the first case. There were no semi-spherical

aggregates formed; the crystals separated out more as individuals, and they were longer and thicker than the first obtained. Some were as long and as thick as an ordinary pin. The mother liquor was removed and the salt dried as described under I. The above quantities of antimony pentasulphide and potassium hydroxide were used because it seemed probable that the salt might be formed in accordance with the eq.; $2Sb_2S_5+9KOH = K_2HSbO_2S_2 + KSbO_3 + 2K_3SbS_4 + 4H_2O$.* On concentrating the filtrate a second crop of crystals was obtained.

ANALYSIS.

Potassium,	23.01	——	——	——	——
Antimony,	36.69	——	36.97	——	——
Oxygen,	——	——	——	——	——
Sulphur,	——	18.38	——	——	18.57
Water,	——	13.27	13.38	13.32	——

SECONDARY POTASSIUM ORTHODISULPHOXY-ANTIMONIATE.

The question now arises, what is this salt? As I have already indicated, there are three possibilities. It is either (a) a double salt, (b) a pyrosulphoxy-salt or (c) a secondary orthodisulphoxyantimoniate. The chances of its being a double salt in the Rammelsberg sense are extremely improbable, for from our modern standpoint a dualistic conception in regard to the composition of a compound is scarcely permissible when the constitution can be equally well expressed by means of a unitary formula. If we define a double salt to be a polybasic acid in which the hydrogen is partly or wholly replaced by equivalent amounts of two metals, the compound in question will be removed at once from the class of double salts. This must be so, for the salt contains but *one* metal. This fact, along with the occurrence together in a compound of an oxy— and a sulpho-acid of the same element puzzled Rammelsberg, and he is very careful to point out that, with one possible exception,* the phenomenon is unique. Is it a pyrosulphoxy-compound? We have no definite means for deciding against this view, but there is no reason why we should assign to the salt the more complex pyro-structure when the facts can be equally well accounted for by regarding it as a simple ortho-compound. The salt exhibits the characteristics of a sulphantimoniate far more than it does those of an oxyantimoniate. As far as I can discover no pyrosulphantimoniates have ever been prepared, whereas the ortho-compounds are well known, hence it would be gratuitous to write the formula for the salt $K_4Sb_2O_3S_4 + 5H_2O$. When heated it acts precisely as a secondary ortho-salt would be expected to behave. At 110° it loses very little water—only a few milligrams. When kept, however, for about two hours at 150° four-fifths of the water escapes. At 250–260° the last traces of water evolved and the salt is yellow and anhydrous.

As proof of my statement I offer the following determinations of the water in a sample of the salt:

0.8474 gram salt was kept at a temperature of 145–150° for 2 hrs. and then weighed. It was again placed in the air bath and kept at 145–160° for 1½ hrs. The weight remained constant. The loss amounted to 0.0888 gram = 2.74 % H_2O. 10.48 + 2.74 = 13.22 % H_2O, while theory demands 13.57.

The determination was made a second time with 0.8407 gram salt. At 145–150° it lost 10.68 % H_2O, and at 250–260° 2.70 % H_2O. 10.68 + 2.70 — 13.38 % H_2O.

Assuming then that the water which es-

*$2Sb_2S_5 + 9KOH = 3K_2HSbO_2S_2 + K_3SbS_4 + 3H_2O$. A portion of the salt, however, owing to its instability, decomposes—splitting up into potassium metantimoniate and potassium sulphantimoniate:

$2(K_2HSbO_2S_2) = KSbO_3 + K_3SbS_4 + H_2O$.

*Berzelius' $K_2WO_4 + K_2WS_4$ is undoubtedly a sulphoxywolframate—$K_2WO_2S_2$. I hope to examine this compound soon.

capes at 140–150° is water of crystallization, while that evolved at 250–260° is water of constitution, the simplest and most consistent formula we can assign the compound is unquestionably $K_2 H Sb O_2 S_2 + 2 H_2 O$. In other words it is the secondary potassium salt of orthodisulphoxyantimonic acid.*

Calculated for $K_2 H Sb O_2 S_2 + 2 H_2 O$		Found.				
K_2	78.06	23.59 %			23.01	
H	1.00	0.30 "				
Sb	120.00	36.27 "			36.69	
O_2	31.92	9.65 "				
S_2	63.96	19.33 "			36.97	
$2 H_2O$	35.92	10.86 "				
	330.86	100.00				
			0.30	0.30		
			18.38			
			1068	10.48		
						18.57

REACTIONS.

The hydroxides of the alkaline earth metals produce in aqueous solutions of the salt white precipitates which on standing become crystalline. Silver nitrate gives a jet black, copper sulphate a dark red and lead acetate a cherry red precipitate. The two latter precipitates become black on standing. The precipitates do not appear to be sulphoxy compounds.

If an aqueous solution of the salt be treated with a few drops of acetic acid a very small amount of sulphuretted hydrogen is evolved; the liquid becomes orange in color, but it remains perfectly clear for days. If the flask containing the solution be corked immediately after the addition of the acid, and well shaken, the sulphuretted hydrogen evolved is soon absorbed, and so completely that the atmosphere of the flask is without action on acetate of lead paper.* When hydrochloric acid is added to a solution of the salt a mixture of antimony pentasulphide, antimony trisulphide and free sulphur, along with some antimony pentoxide and antimony trioxide is precipitated, while small amounts of antimony pentoxide and antimony trioxide remain in solution. The more acid is added, care being taken not to add enough to attack the sulphides, the more pentoxide and trioxide remain dissolved. In this case also traces of sulphuretted hydrogen escape, but if the experiment be conducted in a closed flask which is occasionally well shaken, the gas is after a short time completely absorbed.

In my qualitative study of the action of acids on solutions of the salt I proceeded as follows: The salt (about one gram) was placed in a small flask, dissolved in water (100 cm^3), hydrochloric acid (5–10 cm^3) added, and the flask corked and violently shaken. After standing until the supernatant liquid was clear, the red precipitate was filtered off, washed thoroughly with water to remove the hydrochloric acid, and then again and again with alcohol and carbon bisulphide. The alcohol and carbon bisulphide washings were collected separately and evaporated. A residue of sulphur remained. The red precipitate, now free from sulphur, was extracted with a strong solution of tartaric acid and then washed with water to remove this. The tartaric acid extract proved on further examination to contain considerable

*K. Preis has prepared the tertiary sodium salt of orthodisulphoxyarsenic acid, $Na_3 As O_2 S_2 + 10 H_2 O$. Ann. d. Chem. 257, p. 184.

*This remarkable reaction would seem to indicate that the sulphoxy-acid is capable of existing in the free state.

quantities of the pentoxide and trioxide. Since relatively large amounts of sulphur were removed by the alcohol and carbon bisulphide, the red precipitate must of course have contained antimony trisulphide. One part of the original filtrate from the red precipitate was tested for antimony pentoxide with potassium iodide, according to Bunsen's method. On the addition of a few crystals of this salt to the liquid it became reddish brown. To the other portion silver nitrate* in excess was added, then potassium hydroxide and finally ammonia. A heavy black precipitate insoluble in ammonia separated out, showing the presence of antimony trioxide. The sulphoxyantimonic acid then, set free upon the addition of a mineral acid to an aqueous solution of the Rammelsberg salt, undergoes decomposition at once, and apparently according to the following scheme:

$$8\,H_3SbO_2S_2 + 12\,H_2O = Sb_2S_5 + 2\,Sb_2S_3 + 5\,S + H_3SbO_4 + H_3SbO_3 + 21\,H_2O.\dagger$$

Of course a great deal will depend upon the strength of the solution, the concentration of the mineral acid and the temperature, but the equation will serve to give a fair idea of the reaction. The presence of antimony pentoxide in the red precipitate and in the filtrate from it is a matter in regard to which I am not quite clear. Judging from what occurs in the corresponding case of the sulphoxy-compounds of arsenic one would expect only a separation of the trioxide.‡ I am devoting much time to a study of this remarkable reaction and will reserve a further discussion of it for a future time when I hope to publish the results of my examination of the action of sulphuretted hydrogen on acid solution of antimonic acid. In the light of the elaborate and excellent work recently done by Dr. Brauner and that shed on the subject by the above considerations in regard to the existence of the sulphoxyantimoniates, the rationale in general, if not in detail, of the action of sulphuretted hydrogen on antimonic acid solutions can no longer be regarded as a mystery.

*In making this test of Rose, the formation of silver chloride does not seem to interfere in the least with the reaction, provided one uses enough of the reagents—especially of ammonia.

†I venture to predict that the orthodisulphoxyantimonic acid first splits up into orthomonosulphoxyantimonic acid and sulphuretted hydrogen, and that it is owing to the interaction of these two compounds along with water that the complex mixture of sulphides, oxides and sulphur is due:

$$8\,H_3SbO_2S_2 + 12\,H_2O = 8\,H_3SbO_3.S + 8\,H_2S + 4(H_2O).$$

‡An analogous decomposition, however, was observed by Michaelis in the case of ordinary sulphoxyphosphoric acid. Berichte, 1872. 4.

[Published in the *American Chemical Journal*, Vol. xvii., No. 10, 1895.]

UEBER DIE ARTEN DER CONJUNCTIVSÄTZE IN DEM GEDICHT "DIU KLAGE."

By J. P. HOSKINS.

The present work which is intended to form a contribution to the historical syntax of the German language has for its subject the subjunctive sentence in the Nibelungen Klage.

Starting out from the point of view that the sentence as such, is the real syntactical unit, the author gives in the first eight pages of the introduction his classification of the subjunctive sentence as found in the Klage, dividing it not only in reference to the use or meaning of the subjunctive but also in regard to the form of the sentence: *i. e.*, to the order of words in the sentence. The remainder of the introduction is devoted to two minor investigations: The first considers the use of the subjunctive mood in the different manuscripts which contain the Klage. The second deals with the influence of the rhyme on the use of the moods. In both cases the results are negative as the differences noted are not great enough to warrant general conclusions.

Part I. takes up the simple or independent sentence. According to meaning the sentences are either optative or potential and under these two heads the different tenses and their meaning are considered, especial attention being called to the use of the auxiliary verbs and the various particles which accompany them.

On the formal side the sentences are classified accordingly as they show the so-called regular, the inverted or the transposed order. These types are shown to be the dominant ones. The few exceptions are then considered and the reasons for the various deviations noted as far as possible.

Part II. which constitutes the greater part of the work, has to do with the dependent or complex sentence. The same general lines are followed out as in Part I. All the uses of the subjunctive mood in the dependent sentence can, as far as their meaning is concerned, be traced back to the optative or potential use of the same mood as it is exemplified in the simple sentence. Accordingly the same twofold classification is observed here and under the optative use of the subjunctive we find the sentence expressing purpose and the concessive sentence treated. Under the head of the potential use all the other dependent subjunctive sentences are grouped, the principal classes being the conditional sentence, sentences after a negation in the governing clause, and sentences in indirect discourse. Besides the tenses and their meaning, the sequence of tenses is treated in all the groups.

A number of paragraphs are then devoted to the position of the dependent sentence and it is shown that the dependent sentence follows the governing sentence in all groups except the concessive and conditional sentences. Here the dependent sentence can often precede the one upon which it depends.

In regard to the order of words in the dependent subjunctive sentence the author shows that the type of sentence used depends upon the fact whether the dependent sentence is connected by a conjunction or other connecting word (interrogative pronoun, etc.), with the governing one or not. In the former case the so-called transposed order is the rule although the exceptions are very numerous. Where no conjunctions or connecting word is present the sentences show either the regular or the inverted order according to the rules which govern the simple sentence. The deviations from these types are in almost all cases traceable to the exigencies of the rhythm or the rhyme.

[Inaugural Dissertation, Berlin, 1895.]

WILLIAM WORDSWORTH.

By T. W. HUNT.

In this article, Professor Hunt discusses, at some length, Wordsworth's theory of poetry; his view of nature, and the salient characteristics of his verse, ethical, emotional and intellectual, not forgetting, however, to emphasize those mental and literary limitations of which every candid critic must be aware. Special attention is given to the opposition which his new poetic theory evoked; to the justification of his peculiar conception of the natural world against the charge of Pantheism; to the Hebraic gravity, the essential emotiveness, and the psychological elements of his verse as, also, to his acknowledged lack of those deeper impulses and larger outlooks that mark the work of our highest poets.

[In *Bibliotheca Sacra*, January, 1896.]

FICTION AS A COLLEGE STUDY.

By BLISS PERRY.

Recent discussions of the importance of fiction as a literary form suggest the question of its educational value. Experiments by teachers of English seem to prove that

compared with other types of imaginative literature, prose fiction more readily stimulates the attention of students, and affords at least as wide a range of material for the study of expression. College courses in fiction may be devoted to the historical development of the novel, to the direct criticism of contemporary work, or to the æsthetic principles involved in the art of fiction. While the first two of these methods have some obvious advantages, especially for advanced students, it is important that beginners should be grounded in the laws of the art. These are to be formulated after an examination of the relations of prose fiction to poetry and the drama, as media of expression, and an analysis of character-drawing, plot and setting in works of fiction that have stood the test of time. Some such mastery of principles is to be insisted upon, in view of the present need of an intelligent conception of the aim and scope of the novel.

[Abstract of a paper read at the meeting of the Modern Language Association of America at New Haven, Conn., Dec. 28, 1895.]

TWO PASSAGES IN ARISTOPHANES' CLOUDS.

By S. R. WINANS.

I. Lines 175–180 are a much vexed passage. Although G. Hermann's happy conjecture (1830) of *θυμάτιον* for *θοἰμάτιον* in line 179, noting the customary sacrifice in the palaestra, has been adopted by nearly all recent editors, the current interpretations of the passage are still confessedly unsatisfactory. The supposed method of procedure is clumsy, and the humor falls short of the climax expected. An explanation remains, which seems fully to clear up the difficulties.

First, the scene is the *school* itself, not the palaestra. The audience must assume the school as the scene, for the palaestra is not mentioned or suggested till the end.

Secondly, the *modus operandi* is not physical, tactual, but magical—in short, it is *sorcery*. Socrates of the play is a multiple character. Like the demon of Scripture his real name is Legion; he stands for every sort of sophist and theosophist, physicist, charlatan, and wizard. See the list, lines 331–3. Witchcraft was a notion familiar to the audience, and popular belief in it was extensive. The only definite idea Strepsiades has about the school is that some species of the Black Art is practised and taught there, and he is continually seeking for a sign. Note 189–190, 215, *et al.*, and at 749 his despairing proposal to buy a Thessalian witch.

The underlying motive of the whole longer passage 133–180 is a lampoon on the scientists. So here, while an older pupil plays upon the verdancy of the new comer, the poet at the same time hits at the mathematicians and astronomers. *ἐπαλαμήσατο*, 176, is distinctly a cue word. The recourse, then, is to magic, mathematical magic—the distance-taking of the famous geometer Thales extended to taking things from a distance. The skewer, 178, is used of course on account of its strong natural affinity for meat. *ὑφαιρεῖν* was a mathematical term, with good punning possibilities, 'subtract,' 'abstract.'

To translate:

PUPIL.—'Last night at supper-time we had no food.

STREPS.—I see. Now tell me quick his trick for bread.

P.—Upon the table some fine dust he spread,
Next bent a skewer, made dividers neat—

[No lacuna, but a solemn pause; twirls the imaginary compasses, draws lines, takes directions, then points off—triumphantly.]

From the *Palaestra* he deduced our meat.

S.—'Tis wonderful! Old Thales is outdone.'

The allusion to Thales now gets a better point. He is apostrophized not as the sage, but as the geometer who calculated eclipses and, in the popular belief, taught the Egyptians how to take the height of their pyramids. It is as if an American

appealed to Ben Franklin not as Poor Richard, but in his great act, *eripuit fulmen caelo.*

II. Line 1474. The line is genuine. No adequate motive for foisting in such a line is suggested. It points to a humorous feature of the scene which has not been understood.

Dinos, 'Volution,' is the new cosmic force of the school; Dinos has dethroned Zeus (381). The scholiast tells us *dinos* was also the name of a big top-shaped earthen jar. Now we are not to suppose (with the scholiast) that Socrates had such a jar in his school, or that Strepsiades really confounds the piece of pottery and the new deity. In the scene he is still before his own house. Aforetime he has had statues of the Gods—one of Poseidon (83), one of Hermes, like every pious Athenian, at his house-gate (1478; cf. Thucyd. vi. 27).

Poor emancipated Strepsiades is deficient in 'cosmic enthusiasm.' 'Compelling forces' and 'streams of tendency' are too intangible for his faith to grasp, and he has invented a statue of his god.

In place of Hermes at his house-gate stands a big earthen δῖνος, his best attempt to figure forth the new cosmic deity, 'Volution,' 'in the marble undecaying.'

At 1472, Strepsiades undergoes a revulsion of feeling; catching sight of his Δῖνος statue (σὲ 1474) he smashes it into bits, re-erects his prostrate Hermes, and before it bends the knee in prayer (1478 ff.).

[Abstract of Notes in *Amer. Journal of Philology* xvi., 1., where the passage, 60-78, also is discussed.]

NOTES.

Studies from the Princeton Psychological Laboratory, by J. Mark Baldwin, H. C. Warren and W. J. Shaw.*

Five papers in all, giving the output of the new laboratory for the first year. Among the results of most interest reported in these studies may be mentioned the following: The relative falling off in the accuracy of memory after intervals of 10, 20, and 40 minutes is shown by curves, the thing remembered being square magnitudes exhibited to large classes of students. A contrast effect of squares of different sizes shown simultaneously to the eye was discovered, as reported in a detailed 'Study.' It was found that the distance between two squares of different sizes can not be accurately bisected by the eye. There is a constant error in judgment toward the smaller square whether the two be arranged horizontally or vertically. And the error in finding the midpoint increases as the disproportion between the two squares becomes greater, but always in the same direction. This was tested by different methods, one of which was designed to rule out the effect of eye-movements. Another 'Study' on 'Types of Reaction' reports two cases of reagents who give shorter 'sensory' than 'motor' reactions. Professor Baldwin, the author of this paper, accounts for these cases, and earlier ones on the general view of mental types founded on recent cases of aphasia. The last 'Study' is by Mr. H. C. Warren on 'Sensations of Rotation.'

The Origin of a 'Thing' and its Nature: J. Mark Baldwin.*

This paper is a discussion of the problem as to how far the theory of the origin or natural history of a thing can give an adequate statement of its nature and value in the system of the world. It aims to bring to the bar the claim of the evolution theory that it explains things by describing their history in a develop-

Psychological Review, May, 1895. Reprinted in No. 2, of *Princeton Contributions to Psychology.*

*In the *Psychological Review* for Nov., 1895. Reprinted in *Princeton Contributions to Psychology*, No. 3.

ing series. The author propounds a distinction between the 'retrospective' and the 'prospective' points of view, claiming that the evolutionist takes exclusively the former; but since all growing, developing, things are never exhausted at any stage to which their career has already attained, more career is always to be expected. This expectation of more career, of further development, supplies the 'prospective' reference of reality; and the habit of mind which looks forward rests on the same kind of experience of nature that the historical or evolution habit of mind does. And since all reality is an organized system, whose career is never finished in our experience, we must think also prospectively. Under this head the author brings the older conceptions of teleology, intuition, ethical values, the activity of volition, etc., *i. e.*, they are all illustrations of thinging in the 'prospective reference.' Systems of philosophy are criticised from the point of view gained from this distinction. Finally these two habits or thoughts are connected respectively with the two principles of organic and mental development called Habit and Accommodation in the author's recent work on 'Mental Development.'

The Perception of two Points not the Space-Threshold: Guy Tawney.*

A re-examination† of the sensibility of the skin to differences of position when two points are touched at slight distances apart. A variety of semi-spacial distinctions are discovered when the two compass points are nearer than can be clearly distinguished; and the writer takes these vague judgments of size, direction, etc., to indicate that the distance just felt as two stimulations is not really the 'threshold' for space perception, as is generally supposed; but that there are indications of a confused 'extensity' sensation in connection with all touch stimulations.

A series of annotated "English Classics" planned by Messrs. Longmans, Green & Co., is being published. A new volume in that series, "Scott's Woodstock," edited by Professor Bliss Perry, deepens the impression made by the earlier numbers that this series is one of unusual excellence in the editing, and will prove a valuable auxiliary in the reform of English teaching now generally in progress. "The works prescribed for reading are treated, in every case, as literature, not as texts for narrow linguistic study, and edited with a view to interesting the student in the book in question, both in itself and as representative of a literary type or of a period of literature, and of leading him on to read other standard works of the same age or kind understandingly and appreciatively." In the "Woodstock," for example, we have, in addition to the unabridged text of the novel, a careful editorial introduction; the author's introduction, preface, and notes; a reprint of "The Just Devil of Woodstock;" and such foot-notes as the student will need as he turns from page to page. Besides all this apparatus, many of the chapters have appended a few suggestive hints for character-study, collateral reading, and discussions of the art of fiction. All this matter is so skilfully distributed that it does not weigh upon the conscience, and is not likely to make the student forget that he is, after all, reading a novel chiefly for the pleasure it affords. The entire aim of this volume and its companions is literary, rather than historical or linguistic, and in this fact their chief value is to be found.

Professor Hunt is publishing in *The Treasury* for 1896 a series of papers on English authors from Bacon to Carlyle, under the head of "Literary Life and Sketches."

* Ex-Fellow Princeton College.

† In the *Psychological Review* for Nov., 1895. *Princeton Contributions to Psychology*, No. 3.

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EXPERIMENTS WITH THE ROENTGEN RADIANCE.

By W. F. MAGIE and H. D. CARPENTER.

In the following article we have collected a number of scattered observations, made during the course of our work on the Roentgen rays. Many, if not all, of these have been made by other observers, and have been described elsewhere, so that as they here appear they are to be considered rather as confirmations of already published work than as original contributions to the subject.

The current we have used was obtained from a large induction coil, furnished with the ordinary automatic circuit breaker and with a condenser in the primary circuit. This arrangement has the advantage of sending the discharge through the vacuum tube almost altogether in one direction, so that the cathode discharge comes from one of the two electrodes. As will be seen when we describe the form of tube which we have found most efficient, this condition is essential for obtaining clear and definite outlines on the photographic plate. The intensity of the action seems to depend, *ceteris paribus*, on the electromotive force. Thus the fluorescent screen of the skiascope, whose illumination depends entirely on the intensity of the Roentgen action, will glow more brightly as the electromotive force of the discharge is increased. The action on the photographic plate, which is a cumulative one, depends also on the frequency of the discharge, and, no doubt, the time of exposure can be considerably reduced by using a mechanical circuit breaker that will interrupt the current in the primary more frequently than is done by the ordinary hammer and anvil breaker.

The fluorescent substances which have been used in the screen of the skiascope are the platinobaricyanide and the tungstate of calcium. Of the former salt a large quantity was kindly prepared for us by Mr. Hulett. By mixing with the salt a little (about 4 per cent.) powdered bismuth, Mr. Hulett prepared a screen by which the same intensity of illumination was obtained, with increased definition, as that exhibited by a screen of the pure salt of five times the thickness. The tungstate of calcium was obtained from Eimer and Amend. It appears, from the few tests we have made, to give slightly better results than the other salt.

Photographic plates of various kinds have been used, the Hammer, Carbutt, Cramer, Stanley, Seed, and Wuestner orthochromatic. They all gave good results, and we have not made any rigorous comparisons among them. On the whole, we obtained the greatest density with the Hammer and Stanley plates, and the best definition with the Cramer. The plates have been developed with pyro, eikonogen, rodinal, and metolquinol. The last was

the most satisfactory of these developers. It permitted short exposures, and gave strong negatives.

As a means of investigation the photographic plate is generally to be preferred to the skiascope.

The skiascope shortens the time of an observation and permits the observation of moving objects; but in those cases in which the objects to be observed are small or are surrounded by substance of nearly the same density, or of which clear outlines and accurate detail are desirable, the photographic plate is far superior to any screen which we have constructed. Thus a needle casts no perceptible shadow on the fluorescent screen, while its outline on the plate is perfectly distinct.

The bones of the hand appear in the skiascope with indefinitely defined outlines and there is no perceptible separation between the joints. The bones of the wrist appear as a single mass in which the separate bones cannot be distinguished. On the photographic plate the same objects appear with perfectly clear edges and with perfection of detail.

The most important factor in successful work with the Roentgen rays is the vacuum tube. A first-rate tube must fulfil three conditions. It must give a copious supply of the rays; they must have high penetration; and they must come, as nearly as possible, from a point. The first condition ensures quick action, the second makes it possible to take pictures or obtain images in the skiascope of opaque objects concealed in considerable thicknesses of less opaque material, the third gives sharp outlines or, as it may be called, good definition.

When our work was begun, we were misled, in common with most observers, by Roentgen's statement that the new rays were emitted from all parts of the tube on which the green phosphorescence of the cathode discharge appeared, and believed that sharp definition could be obtained only by placing the object as near as possible to the plate and by the use of a diaphragm. Accordingly a small hole was cut in a lead plate and only those rays emitted by the tube which passed through it were used. The pictures thus obtained gave far better detail than those got when the whole tube was used, but the time of exposure was much prolonged. At last, however, by following the suggestion of Mr. Porter in *Nature*, we tried a tube which gave such excellent results that we have used it in all our subsequent experiments. In this tube the cathode is a spherical cup by which the cathode rays are converged to a point or focus. At this focus is placed a small square of platinum foil, which serves as an anode. Another anode also enters the tube opposite the cathode. From this tube the Roentgen rays are emitted as if they came from a point or small region on the platinum anode. It may be used without a diaphragm, and the pictures taken with it show sharpness of outline and abundance of detail.

The other anode also serves as a source, and a very precise one, of the rays, but they are emitted from it so feebly that, in most instances, their action is not perceptible.

The penetration of the rays, or their ability to pass through sufficient thicknesses of substance to yield useful results, seems to depend not only on the electromotive force, increasing as it increases, but also on the vacuum in the tube.

The proper vacuum is very high, higher than that at which the tubes best exhibit the Crookes phenomena. The ordinary Crookes tubes of the Physical Collection can be made efficient sources of the rays simply by allowing the discharge to pass through them for a sufficient time; as a rule not more than an hour is required. In every case in our experience in which an exhausted tube was subjected to long-continued discharge, the result was, either,

that the tube was ruined by the puncturing of the glass and the consequent loss of the vacuum, or its vacuum was rapidly increased to the desired degree.

In two cases in which tubes were thus treated successfully, the phenomena were so interesting that they will be described somewhat in detail.

In the first of these, the tube was a glass cylinder 6 in. long and 1 in. in diameter. The electrodes were aluminium wires 1 in. long, inserted axially at the two ends.

When the discharge was first passed through the tube, it set up a continuous, apparently unstratified, white phosphorescence throughout the entire tube. After half an hour's running this disappeared quite suddenly, there being left only a light purplish glow around the cathode. At the same time the green phosphorescence of the cathode discharge made its appearance. This was much the brightest around the tip of the cathode; though, as the vacuum continued to increase, all parts of the tube were more or less illuminated by it. Almost immediately upon its appearance, an observation with the skiascope showed that the Roentgen rays were being emitted. The source from which they came, as determined by observing different parts of the tube through a hole in a lead plate, was the region of most brilliant phosphorescence around the tip of the cathode. No action at all could be perceived from other parts of the tube, even from those around the cathode which showed clearly the usual phosphorescence. As the discharge continued the emission of the rays became more and more copious and their penetration steadily increased, so that, after an hour's running, observations could be made of the bones of the arm. At this point, the tube was ruined by the passage of a spark through its wall.

The other tube was one of a set of Crookes tubes. It was a cylinder about 10 in. long and 1 in. in diameter, furnished with a small, flat aluminium anode and a cup-shaped cathode. The cathode stood about 3 in. from the end of the tube and was carried on a shielded wire. Its radius was about $\frac{3}{4}$ in. On first sending the discharge through this tube, it also showed the white phosphorescence throughout. This speedily diminished to two or three phosphorescent masses near the cathode and a smaller one at the anode.

Soon after the bluish cathode discharge could be seen converging to a point and continuing from that point as a divergent cone. The walls of the tube within the limits of this cone then showed the green phosphorescence. There was no evidence from the skiascope of the emission of the Roentgen rays. With increasing exhaustion the cathode discharge diminished in intensity and a faint hemispherical mass of purplish light which was present on the face of the anode also decreased. Suddenly and apparently coincident with the complete disappearance of the light at the anode, the anode became red-hot, partly melted and the sudden emission of vapor again filled the tube with white phosphorescence. The tube was not, however, completely restored to its original condition, for a few minutes running, during which the anode remained red-hot, was sufficient to clear the tube of the white phosphorescence, to carry it through the stage in which the green phosphorescence appeared in the cone of the cathode rays and to bring it to its final condition. In this condition the only phosphorescence visible was a brilliant patch on the end of the tube around the anode. The anode itself was no longer red-hot. The tube in this state emitted the Roentgen rays in large quantities and with high penetration. Trials with the skiascope showed that they came from the anode end of the tube, but the tube was punctured by a spark before tests could be made with the photographic plate to determine the precise point of emission.

The continued increase in the vacuum, exhibited by all these tubes, works at last disadvantageously by increasing the difficulty of sending a sufficient discharge through the tube. We have found that the tube may be restored by gently heating it.

In the case of the spherical tube previously described, the vacuum was thus brought to such a point that the platinum foil was heated red-hot by the cathode discharge. After five minutes running all visible signs of a heating effect passed away and the tube became again an efficient source of the rays.

It has been used for about two weeks since it was thus treated and is now apparently passing through the same stages of exhaustion that it showed when first used.

When the tube was in the best condition, the time of exposure of the photographic plate varied, according to the difficulty of the object, from five minutes to one hour. The objects here referred to are parts of the body. Pictures of coins and other things of that sort could be obtained in much shorter time. The hand is the easiest object and a good picture of it can be taken in five minutes. The wrist and forearm needed 15, the elbow 30, the knee 40. A good picture of the neck and the lower part of the skull was taken in 45 minutes. The shoulder requires longer time. As the thickness of the mass of flesh is increased through which the rays are sent, the distinction between the shadow of the bone and the flesh becomes less and less marked, so that the skiagraphs of thick parts of the body are thin and show little detail.

The studies we have made of the various possible physical properties of the rays have yielded little beyond negative results. Several attempts were made to detect a true reflection. The reflecting surfaces used were polished steel and platinum. In neither case was there any evidence whatever of reflection. This failure does not in any sense disprove the existence of such a reflection, which is apparently established by the labors of Rood and others. In any case the intensity of the reflected action is very little and our inability to exhibit it can be explained in various ways.

In the examination of the rays for refraction two substances were used, crown glass and Iceland spar. The glass was in the form of a prism and of blocks with parallel faces, through which the rays passed obliquely. The bodies whose shadows were examined were steel wires, placed so that they protruded on each side of the glass. In no case was there any evidence of the displacement of that part of the shadow which fell within the shadow of the glass.

Similar experiments were made with a block of Iceland spar. In no case was any refraction observed. There was, however, in many of the trials a curious bending of the shadow, beginning at the edge of the shadow of the spar, and reminding one of the appearance of a straight stick partly covered by water.

There was no evidence of double refraction in these experiments. Pictures were taken of the shadow of a pin over parallel and crossed tourmalines. In the two cases the image was equally distinct. There appears to be a slight displacement of the image in one case.

Around the outline of the shadows of wires, etc., especially when the objects were raised above the plate, there was generally a narrow dark line, indicating a more intense action at the edge of the shadow. This may be explained by reflection from the wire at nearly grazing incidence.

Trials were made for diffraction phenomena by sending the action through a pair of slits in the way in which the experiment would be arranged for the diffraction of light by a slit; but though the slits exhibited light diffraction very well, there was no evidence by a widening of the image on the plate that the rays had been diffracted in the slightest degree.

THE VALIDITY OF THE VAN'T HOFF CONSTANT EXPERIMENTALLY EXAMINED.

By E. H. LOOMIS.

In a recent paper (1) the author has submitted an extended series of observations on the freezing points of dilute aqueous solutions. The method employed is the one which was described by the author two years before. When it is remembered that the freezing points of these solutions must be known with accuracy reaching into the ten-thousandths of a degree to test the validity of various conflicting theories of "solution," we are not surprised at the large number of investigators who have sought to overcome the experimental difficulties which the problem involves. That these difficulties are of no ordinary magnitude may be gathered from an examination of the various determinations of the freezing point of some particular solution, as for example, a tenth normal solution of sugar (containing about 3.3% sugar.)

Observer.	Year of Publication.	Freezing Point.	Estimated Error.
Raoult I.	1886	0°.24	0° 01–2
Arrhenius I.	1888	0°.210	0°.0–05
Traube	1891	0°.235	0°.005
Eykmann	1891	0°.216	—
Arrhenius II.	1891	0°.204	—
Tammann	1891	0°.206	—
Pickering	1891	0°.202	0°.0005
Raoult II.	1891	0°.205	0°.002
Loomis	1891	0°.190	—
Jones	1891	0°.197	0°.0001–2
Nernst and Abegg	1891	0°.187	—
Wildermann	1894	0°.190	0°.0001–2

Here we observe that the results vary more than a *twentieth* of a degree. That determinations of a given freezing point by such careful observers as Raoult and Arrhenius should differ so largely makes it plain that the observations involve the greatest experimental difficulties.

The degree to which these difficulties have been overcome appears from the fact that the more recent observations show a gradually increasing agreement and we are warranted in the hope that the exactness of the methods will be still further increased until complete agreement between the results of different observers may be secured.

Before passing to the results of the new series of observations it may be well to call attention to the special advantages which appear to distinguish the present method.

1. The freezing-point is determined with so slight traces of ice present that no correction for change of concentration in the solution is necessary. (The overcooling is but 0°.15 C.) I am not aware that the value of this correction so generally applied in other methods has been experimentally determined, and since it not infrequently amounts to 10 per cent. of the entire observed depression it may perhaps be dangerous to apply it without some experimental justification.

2. The method eliminates all possibility that the observer's bias may affect the results.

3 The reading of the thermometer is made with the mercury column absolutely stationary during 1–2 minutes.

4. The solution to be examined, as well as the water in which the zero point of the thermometer is determined, is surrounded by a medium which is but 0. 3° C. below its own freezing-point, and is further carefully insulated from this by two glass walls and the air layer between them. Thus the solution and its "ice" are able to come to their equilibrium-temperature in as nearly an adiabatic condition as possible.

It should be added that the experimental details of the method were perfected by making many *thousand* observations

(1) Wiedemann's Annalen, 57, p. 495, 1896.

on the freezing-point of pure water, and that the method was not applied to dilute solutions until the freezing-point of water could be fixed upon the thermometer to within a possible error of 1–2 ten-thousandths of a degree.

The high degree of accuracy which the method promised in the earlier work seems to be fully realized in the larger application which it has now received.

The present observations include solutions of the following compounds:

KCl, NH_4Cl, $BaCl_2$, $MgCl_2$, HCl, K_2SO_4, Na_2SO_4, K_2CO_3, Na_2CO_3, KNO_3, $NaNO_3$, NH_4NO_3, and H_3PO_4.

Before examining the experimental results with a view to testing the validity of the van't Hoff constant, it will be well to consider the thermodynamic problem whose brilliant solution by van't Hoff led at once to the theoretical calculation of the freezing points of all aqueous solutions of the non-electrolytes.

We assume that the solution is extremely dilute, and that in the process of freezing the solvent alone solidifies. It has been shown by the experiments of Pfeffer and others that the osmotic pressure of a given substance in solution (2) varies directly as the absolute temperature and concentration of the solution. By the concentration of a solution is meant the ratio of the mass of the *solyte* to its volume. This volume is determined by the volume of the solution and is increased or decreased by the addition or removal of the solvent. This relation of the osmotic pressure of a given substance to the absolute temperature and concentration (or density) is the same as that expressed by the laws of Boyle and Guy Lussac in regard to the pressure exerted by gases, and leads at once to the same general equation

$$p\,v = R\,T$$

(2) For the substance dissolved the term *solyte* has been suggested. The need of such a term is apparent and it will be employed in this connection thoughout this paper.

in which p is the osmotic pressure. The other terms have the usual significance.

Now the experiments of Pfeffer lead to the same value for the constant R as obtains for gases and we thus reach the important result:—

The pressure (osmotic) exerted by a substance in solution is the same as would be exerted by it if it were a perfect gas occupying the same volume as that of the solution.

Let us suppose that the solution whose freezing point is to be calculated is made up as follows:—

n = number of grams of the solyte.
m = molecular weight of solyte.
1000 c.c. = Volume of the solution.
w = heat equivalent of fusion for the solvent per unit volume.
T = absolute temperature of freezing point of solvent.
Δ = depression of freezing point due to the solyte.

It is this value Δ which is to be determined.

Suppose the solution to freeze until so much of the solvent has solidified as contained a single molecule of the solyte. Since obviously the total number of molecules is $\frac{n}{m}$, the volume of the solvent thus removed would be $1000\frac{m}{n}$, and the heat which would be given up by the solidifying of this volume would be $1000\frac{m}{n}w$. The freezing of this $\frac{m}{n}$th part of the solvent has decreased the volume of the solyte by this amount and this decrease of volume has been effected against the constant osmotic pressure p. Thus the work done is expressed by p.v, where v in this particular case is $\frac{1000\,m}{n}$; and since

$$p\,v = R\,T$$

we have

$$R\,T = p.\frac{1000\,m}{n} = \left\{\begin{array}{l}\text{mechanical work}\\ \text{done in the pro-}\\ \text{cess of freezing.}\end{array}\right\} \quad (1)$$

In order to determine how much heat has been "converted" in the performance of this amount of work we must conceive the freezing process to be separated into a series of reversible transformations as follows:—

(1) At the temperature T let the volume $\frac{1000\,m}{n}$ of the solvent be separated from the solution. The work done against the osmotic pressure is $p.\frac{1000\,m}{n}$

(2) Let this part of the solvent freeze at the temperature T. The quantity of heat given up during this isothermal change is $\frac{1000\,m}{n}w$.

(3) Let the temperature of both solution and "ice" formed in (2) fall to $T-\Delta$, and then add the ice to the solution. The ice will be just melted and the temperature will remain at $T-\Delta$.

(4) Give such a quantity of heat to the solution that its temperature is again raised to T.

The transformations here indicated form a perfectly reversible cycle and the second Law of Thermodynamics may be directly applied.

We thus find that the amount of Heat converted in the process is the $\frac{\Delta}{T}$th part of the whole quantity of heat transferred, that is, $\frac{1000\,m}{n}w\frac{\Delta}{T}$.

We thus have from (1)

$$\frac{1000\,m}{n}w\frac{\Delta}{T} = RT$$

In this equation R, expressed in calories when the volume-change is equal to that part of the solution which contains a single molecule, reduces to 2 and we have

$$\frac{1000\,m}{n}w\frac{\Delta}{T} = 2\,T, \text{ or}$$

$$\Delta = \frac{0.002.T^2}{w}\frac{n}{m} \quad - - - - \quad (2)$$

But the factor $\frac{0.002.T^2}{w}$ is constant for the given solvent, and the other factor $\frac{n}{m}$ is the number of molecules of the solyte per liter of the solution; that is, it is proportional to the concentration of the solution.

We thus have two important laws:

(1) The depression of the freezing point of any solution is proportional to the concentration.

(2) Equally concentrated solutions of all substances in a given solvent, namely, such as contain the same number of molecules of the solyte per liter, have the same freezing point.

The first law is identical with that experimentally discovered by Blagden, while the second is the generalization reached by the experiments of Raoult. The value of the constant $\frac{0.002\,T^2}{w}$ in the case of water as solvent, putting $T=273$ and $w=79$, is 1.89. This is generally known as the van't Hoff constant for water from the fact that he first determined its value theoretically as has been shown above.

In order, thus, to calculate the freezing point of any given solution we have only to multiply the van't Hoff constant of the solvent by the molecular concentration of the solution and subtract this product from the freezing point of the solvent itself.

Thus for a $\frac{1}{10}$ gram molecular sugar solution, (containing 34.2 grams sugar per litre, since the molecular weight is here 342,) we have the required depression equal to 0.189°, and the solution should freeze at −0.189° C. This is very nearly the value found experimentally, see p (31), and should be the same for all $\frac{1}{10}$ gram molecular solutions of all organic non-elec-

trolytes in water. The author has found for a few of the most characteristic substances of this class the following values, largely selected from experimental data not yet ready for publication:—

Ethyl Alcohol,	—0.183°
Methyl Alcohol,	0.177
Glycerine,	0.190
Glucose,	0.188
Sugar,	0.190
Urea,	0.182
Acetic Acid,	0.185

The agreement here exhibited is sufficient to establish the validity of the van't Hoff Constant for this class of solutions, since it must be remembered that the theoretical deduction of its value proceeds on the assumption that the solution is so dilute that the individual molecules of the solyte are entirely beyond the spheres of their mutual actions, that is, that we have to do with an 'idcal' solution, in which alone, as in the case of ideal gases, the equation,

$$pv = RT$$

holds true.

The van't Hoff Constant in case the dissolved substance is an Electrolyte.

It is a well known fact that in cases of such electrolytes, for example as sodium chloride, which contain only *univalent* radicals, the depression of the freezing point for a given concentration is almost twice as much as the van't Hoff constant requires and that in case of elcctrolytes containing *bivalent* metallic radicals this depression is about three times too large. Thus for NaCl, the author has found for the freezing point of a $\frac{1}{10}$ gram molecular solution—0.367° and for a like solution of $BaCl_2$—0.449°. The reconciliation of these facts with the van't Hoff formula we owe to Arrhenius. He assumes that these electrolytes in solution are for the most part broken up into their constituent ions, and that each of these individual ions plays the same role as far as the depression of the freezing point is concerned as the original molecules. Thus the number of "active molecules" is greatly increased by this splitting up of the molecules. He has used the word "*dissociation*" to describe this state of an electrolyte in solution.

This dissociation leads to an increase in the molecular concentration of the given solution, and a consequent increase in the depression of the freezing point. In case of *complete* dissociation of a NaCl solution, for example, the number of active molecules would be doubled and the depression of the freezing point of a $\frac{1}{100}$ molecular solution would become $0.0189 \times 2 = 0.0378°$ The observed value is 0.0367°. and indicates that the dissociation at this concentration is not quite complete.

The determination, then, of the degree of dissociation in solutions of these electrolytes is a matter of fundamental importance. It so happens that this may be done with the utmost exactness when the molecular electrical-conductivity of the solution is known together with the limiting value which this conductivity approaches as the solution becomes infinitely dilute. Both these values are known from the experimental work of Kohlrausch on the conductivity of aqueous solutions.

Thus, if the molecular conductivity of the given solution is indicated by μ_x and the maximum valuc toward which this *molecular* conductivity tends as the dilution becomes greater is μ_∞ then thc *degree* of dissociation of the electrolyte in the given solution is expressed by $\frac{\mu_x}{\mu_\infty}$. This follows directly when it is assumed, in accordance with the views of Clausius and Arrhenius, that the conductivity of a solution depends solely on the relative number of the dissociated molccules which exist in the solution. This assumption is fully verified by the results of Kohlrausch's work.

Knowing now the value of the "dissociation" we are able to calculate the true value of the molecular concentration. Thus suppose we take a $\frac{1}{100}$ gram-molecule NaCl solution (since the molecular weight of NaCl is 58.5, such a solution would contain 0.585 grains NaCl per liter).

The value of $\frac{\mu_x}{\mu_\infty}$ or degree of dissociation in this case is $\frac{96}{104}$ or 92.3%. Thus for every 1000 molecules of NaCl put into the solution 923 are dissociated and yield twice the number or 1846 "active molecules." These together with the molecules which remain undissociated *i. e.*, 77 make the number of active molecules in the solution, 1846+77=1923.

The molecular concentration is thus increased 92.3% and we have for the required depression of the freezing point

$$\Delta = 1.89° \times \tfrac{1}{100} \times 1.923 = 0.0363°.$$

The observed value is 0.0367°.

Similarly for electrolytes containing bivalent radicals, as H_2SO_4. Here the degree of dissociation in a $\frac{1}{100}$ gram molecular solution is 69.8%. Since in this case each molecule splits into three groups, H, H, and SO_4, from every 1000 H_2SO_4 molecules put into the solution we obtain $(698\times 3)+(1000-698)=2396$, and

$$\Delta = 1.89° \times \tfrac{1}{100} \times 2.396 = .0453°.$$

The observed value is 0.0449°.

This remarkable agreement between the theoretical and observed depressions makes it probable that the van't Hoff Constant is valid in the case of the electrolytes as in the case of the non-electrolytes. The new experimental data which the present work furnishes confirms this conclusion. It will be possible here only to glance at a small portion of the new material. Let us, for example, compare the observed freezing points of the various $\frac{1}{100}$ gram molecular solutions examined with the values calculated from the van't Hoff Constant and the known value of the dissociation. These values are given in the following tables.

COMPOUND.	OBSERVED DEPRESSION.	CALCULATED DEPRESSION.
KCl	0 0360°	0.0365°
NH_4Cl	0.0356	0.0367
HCl	0.0361	0.0371
$BaCl_2$	0.0499	0.0520
$MgCl_2$	0.0514	No available data.
K_2SO_4	0.0492	0.0495
Na_2SO_4	0.0509	0.0496
K_2CO_3	0.0507	0.0466
Na_2CO_3	0.0507	0.0454
KNO_3	0.0346	0.0362
$NaNO_3$	0.0355	0.0365
NH_4NO_3	0.0358	No data a ailable.
H_3PO_4	0.0282	

The agreement between the calculated and observed expressions presented by this extended series indicates that the van't Hoff Constant is valid. The marked exceptions are in the cases of Na_2CO_3 and K_2CO_3. In regard to these it should be remarked that the value of μ_∞ can not be deduced from Kohlrausch's results with any degree of accuracy and thus the calculated values of the depression in these cases are hardly more than rough estimations.

It needs to be added that this conclusion in regard to the validity of the van't Hoff constant is further sustained by the results obtained during the past Winter. These cover a large range of electrolytes as well as non-electrolytes. The results will be published later.

[Physical Labratory, Princeton, May 1, 1896.]

SUMMARIES OF PAPERS READ.

GENERAL PRINCIPLES OF CHURCH UNITY.

By CHARLES W. SHIELDS.

The Church Unity movement is universal and deep seated throughout Christendom. It may be explained as a reconciliation of primitive apostolic tendencies; as a logical completion of the history of Christian doctrine; as a reaction from the sectarian results of the Reformation; as a practical need of Christianity in modern civilization.

The organic unity of the visible church was contemplated by our Lord; was taught by the Apostles; was maintained by the Reformers; and is still attainable, notwithstanding some crude objections.

The only scheme of the general principles of Church Unity, as yet put forth, is the Quadrilateral or Four Articles proposed at Chicago and amended at Lambeth: the Scriptures, the Creeds, the Sacraments and the Episcopate. These principles are in their nature ecclesiastical institutes having organic force and not mere abstract propositions or sentimental professions which only express Christian fraternity without promoting church unity.

The history of the Quadrilateral may be traced in the Muhlenberg Memorial, the secession of the Reformed Episcopal Church, the Revision of the Prayer-book, the Chicago Declaration and the Lambeth revision of that declaration. The logical effect of the Lambeth revision has been to detach the Chicago articles from everything denominational and set them forth as tenets of Catholic Unity in the view of Christendom.

The Lambeth articles afford a large consensus to the Catholic Churches, Greek Latin, Anglican; and a larger consensus to the Protestant Churches, Lutheran, Reformed and Presbyterian. The re-union of the Protestant and Catholic Churches is a remote and difficult problem with some hopeful elements. There are two pre-requisites: 1st, The ecclesiastical unification of Protestant Christianity; 2d, The unification of the Presbyterian and Episcopal Churches.

The failure of the recent ecclesiastical conferences has revealed serious misconceptions on both sides. Presbyterian misconceptions: 1st, As to the spirit of the Episcopal proposals. There is a growing school of Episcopalians who feel their isolation from their fellow Christians. 2d, As to the scope of the Historic Episcopate. It includes the presbyterial as well as prelatical view of the apostolic ministry, and it excludes neither view. 3d, As to the denominational claims of the Protestant-Episcopal Church. The Anglo-American episcopate may have a Catholic unifying mission quite distinct from the denomination to which it is attached.

Episcopalian Misconceptions: 1st, As to the Presbyterian idea of the Church. There is no tenet of sound churchmanship which Presbyterians do not hold as tenaciously as Episcopalians. 2d, As to the Presbyterian conception of a liturgy. The Prayer-book is not an exclusively Episcopalian production, and Presbyterians cannot consistently object to the Westminster edition, for optional use in suitable circumstances. 3d, As to the Presbyterian view of the Historic Episcopate. To some denominations it might appear subversive of their polity; but to intelligent Presbyterians it presents itself simply as a development of the apostolic presbyterate, desirable for the sake of unity and for other advantages.

As yet, the feasible effort for Church Unity is a comparative study of denominational standards on the Lambeth basis

by their respective adherents associated informally in brotherly conference. This is the method, as well as the mission, of the "League of Catholic Unity." The problem is to be solved not so much by logic as by Christian feeling, by mutual tolerance and fraternity. The supreme test is a willingness to include all our fellow Christians in the visible Church of Christ.

[Abstract of a lecture delivered before the Union Theological Seminary, New York, Jan. 13, 1896.]

ON THE MEANING AND PLACE OF HOMUNCULUS IN GOETHE'S FAUST.

By H. C. O. HUSS.

Goethe's tendency towards the enigmatic and the obscure, in composing the Second Part of his Faust, reached its climax in that creation of his imagination to which he gave the name of Homunculus. This luminous being, endowed with reason and speech, though devoid of bodily substance, is produced by Wagner with the aid of Mephistopheles. Being confined within a phial, it lights the way for Mephisto as he carries the sleeping Faust to the Pharsalian Fields, but then parts company with both to attend to its own business among the bewildering mythological crowd of the Classical Walpurgis-Night. Its purpose is 'to arise,' *i. e.*, to get a body, but also to arise 'in the best sense,' *i. e.*, to get a most beautiful body. Therefore, as long as it moves among repulsive Thessalian witches, it distrustfully refrains from the decisive act, but in the presence of Galatea, where everything is 'crowned with beauty,' it shatters its glass and expands into the elements that 'Eros be ruler, who all things begun.'

Commentators most widely differ in their interpretations of Homunculus. A number of them see in him the objective expression of some spiritual condition in Faust, such as his struggling for a new birth into another condition of existence; or his thoughtful striving for Ideal Beauty; or his imperious yearning for the original home-land of Art, and so forth, but the objection to these views is, that all symbolizing is superfluous when the thing supposed to be symbolized is as really and palpably set forth by the poet as Faust's striving for Helen, his ideal, in search of which we even see him descend into Hades. Moreover, if Homunculus really did symbolize so noble an aspiration of Faust's soul, we could not understand why Satan should be his originator.

More recent interpreters hold that Homunculus symbolizes Humanism, yet without advancing convincing arguments; still others, completely nonplussed, see in him nothing but a joke of the senile poet.

In contradistinction to the commentators alluded to, Veit Valentin, the most recent interpreter, sees no symbol in Homunculus, but the living psychic force necessary for reviving the shade of Helen emerging from Hades. Since she is to wed Faust and to become the mother of Euphorion, it becomes a poetic demand that she, for the time being, should exchange her shadowy existence for a real one, *i. e.*, that she should undergo a second incarnation. The animated matter necessary for that is furnished by Homunculus the moment when he, at Galatea's feet, expands into the elements.

With Valentin's interpretation Homunculus receives a most definite meaning and place in the poem and even becomes an indispensable element in its composition, for now only the Helena Act, otherwise isolated, becomes closely connected with the preceding one, a consideration not to be underrated inasmuch as it does due justice to the poet as a dramatist.

[Abstract of a paper read before the Modern Language Club, March 11, 1896.]

ON THE PRESENCE OF CENTROSOMES AND ATTRACTION SPHERES IN THE GANGLION CELLS OF HELIX POMATIA, WITH REMARKS UPON THE STRUCTURE OF THE CELL BODY.

By C. F. W. McCLURE.

V. Lenhossék's paper which appeared in November, 1895, (Archiv. für Mikr. Anat. Band 46. H. 2.) described for the first time, the existence of *Centrosomes* and *Attraction Spheres* in certain of the medium sized spinal ganglion cells of the frog. This interesting discovery led the writer to search for similar structures in the ganglion cells of Invertebrates, in which these structures had likewise never been found. The result of these investigations has been most gratifying, as the above mentioned structures were found, both in the supra- and infra-oesophageal ganglion cells of *Helix pomatia.*

The following description, so far as it is possible to do so without figures, shows that the structure and disposition of these structures in the ganglion cells of *Helix*, is essentially the same as in those cells where they are commonly known to exist and practically the same as described by v. Lenhossék for the spinal ganglion cells of the frog.

In certain of the monopolar ganglion cells of *Helix*, which have a transverse diameter ranging between .17 and .22 m. m., the nucleus was found to have an eccentric position and to be invaginated on the side directed towards the axis cylinder pole of the cell. This invagination though, was not exactly opposite to the axis cyclinder process, but directed to one side of it and in this respect differed from v. Lenhossék's figures. In the protoplasmic body of the cell, opposite to the nuclear invagination, a disc shaped structure was found, which appeared to be finely granular and possessed a well defined outline (*Sphäre* of v. Lenhossék). In some cells, this disc was situated close to the nuclear invagination, while in others it was somewhat removed from it, but always held a position opposite to it.

In the centre of the finely granular "disc" several dark granular bodies were found, which stained much deeper in Heidenhain's iron haematoxylin than the granules immediately surrounding them and which undoubtedly represent the so called centrosomes of certain authors. The protoplasmic body of the cell immediately surrounding the "disc" stained much darker in the above mentioned stain, than the remaining portion of the cell body and by careful focussing, was seen to be composed of fine granules closely packed together, but apparently not possessing a radial arrangement. This latter area undoubtedly corresponds to the "Rindenzone" of Van Beneden.

At the time the above structures were first observed, December, 1895, they were looked upon as rudimentary structures and as instances in which the centrosomes had remained permanently in the cell body, but in no way indicating the existence of an active cell division in the adult ganglion cells.

In describing the structure of the cell body of the ganglion cells of *Helix*, most investigators have observed that it stains much darker than the axis cylinder process, this is due according to my observations, to the presence of a large number of *small granules which have a distinct affinity for basic aniline dyes.* These granules are usually spindle shaped, but often have the appearance of little rods. They are usually arranged in the cell body in rows, which may be short and curved, or the rows may extend for some distance in the cell body parallel to the periphery of the cell and nuclear membrane, in which case the cell has a striated appearance. This is most common in sections through which the axis cylinder process has been cut. In

those cells in which the "Sphäre" is present, the small granules are so closely packed together about the former that it is difficult to say what their arrangement there is, but they appear in some instances to be arranged in rows, while in others to have a diffuse distribution. These rows of granules often have the appearance of fibrils, but if carefully focussed the distinction is clearly seen. Also their definite reaction to basis aniline dyes is sufficient to distinguish them from fibrillar-structures, which, as will be seen on considering the latter are stained in combination stains by acid aniline dyes. These rows of small granules correspond in all probability to the fine fibrils described by Rhode for the same cells. Material hardened in Flemming's solution and stained by the Heidenhain haematoxylin method, shows the rows of small granules very distinctly and if the sections have not been differentiated too much there will also be present a considerable number of spindle-shaped granules which stain quite deeply and are much larger in size than the smaller granules. These are arranged in the cell body with their long axes parallel to the cell periphery and are most plentiful in the endoplasmatic area of the cell. By progressive differentiation of the sections, these larger granules are seen to get lighter in color and by continuing the differentiation process become almost indistinguishable. It is possible that these large granules may represent local collections of the smaller granules which on account of their massing together, have held the stain longer than the smaller granules, that are more widely separated. It is more probable though that they are distinct structures, as their substance appears to be homogeneous. These large granules correspond in all probability to the coarse fibrils figured by Rhode, which he derives from the neuroglia and are not so plainly brought out by other staining methods as by that of Heidenhain. In combination stains, such as methelyn blue and cosin, the granules are stained a deep blue, while the space between them as well as the axis cylinder process stains a reddish hue. Fibrils are distinctly seen in the axis cylinder process and as a rule run in wavy bundles. The fibrils also stain a slightly deeper red than the ground substance and may be traced into the clear space at the axis cylinder pole of the cell, which is practically free from granules and above which the pigment mass is situated. From this point they seem to run into the cell body, but to trace their course there is most difficult on account of the great number of small granules present. So far as can be observed, their course is the same as that of the rows of small granules, whose arrangement into rows is perhaps due to the fact that the granules arrange themselves along or upon the fibrils. All material was fixed in sublimate, where double stains were used.

Material fixed in Flemming's solution and stained with Heidenhain's haematoxylin shows the fibrils most distinctly. That the granules are due to local swellings on the fibrils, as suggested by Pflücke (Zeitsch, für Wiss. zool. Bd. 60, H. 3) for the cells of *Astacus*, there seems to be little evidence. That these large and small granules in the cell body are materially different from the neuroglia tissue, is quite evident from the fact that the latter is always stained by the acid aniline dyes, while the granules are stained by the basic. In carefully prepared sections a distinct difference is also observable between the color of the axis cylinder contents and the surrounding neuroglia tissue. Many other combinations were used besides methylen blue and eosin, all of which produced the same results. Among the best of these was safranin—light green, erythrosin—methylen blue after Held and many others. Although the neurog-

lia is seen to closely envelop the nerve cells in well fixed material, there does not seem to be sufficient evidence to consider that it forms anything more than an envelop for the same, as combination stains enable one to clearly distinguish between the two. Provided neuroglia fibrils do pass into the body of the nerve cells, they more likely represent paths along which lymph channels or blood vessels run rather than a connective tissue stroma of the cell, as figured by Rhode. (Archiv. für Mikr. Anat. Bd. 54. H. 3.)

The structure of many other invertebrate nerve cells was studied, but space will permit only the mention of a few. The structure of the nerve cells of *Astacus*, *Cambarus* and *Homarus* are essentially the same. There are situated in the cell body innumerable small granules as figured recently by Rhode for *Astacus*, which have a distinct affinity for methylen blue, while the axis cylinder process and inter-granular substance is stained by the eosin when combined with the former dye. The fibrils are most distinctly brought out in material hardened in Flemming's solution and stained with Heidenhain's iron-haematoxylin and here as in *Helix* and *Arion*, two kinds of granules large and small are found in the cell body of the nerve cells of the abdominal ganglia.

The granules in these cells are larger and not so compactly arranged as in *Helix* and *Arion*. They often run in rows in much the same fashion as described for the above mentioned species. They also in some sections appear to have a diffuse arrangement. In some cells the axis cylinder fibrils extend into the cell body as a compact bundle of fibrils practically free from granules, as described by *Binet* (Jour. de l'Anat. et de la Physiologie 1894). This he calls the "*Cylindre-axe intracellulaire.*" This is also present in some of the cells of the abdominal ganglia of *Cambarus*, *Astacus* and *Homarus*. In some of these cells it seems to extend around the nucleus and to form a complete loop, about the same, but in no instance was it seen to connect with the nucleus. The axis cylinder fibrils can be traced into the clear area at the axis cylinder pole of the cell and from here seem to pass into the granular area, where their course is difficult to trace, but in all probability as in *Helix* it is along their course that the granules arrange themselves and thus produce the appearance of rows. The structures in cells of *Astacus* which have been described by some writers as vacuoles and by Rhode as ground substance free from granules, are nothing more than sections through the intracellular axis cylinder in which fibrils can plainly be seen. Material fixed in Flemming's solution as mentioned above, shows this most distinctly. At the margins of the intracellular axis cylinder the fibrils are distinctly seen to run into the granular portion of the cell and no sharp line of demarcation exists between the two.

Granules arranged in rows often extend into the intracellular axis cylinder from the granular area of the cell and show most clearly that they are distinct structures and not swellings on the fibrils. Here also their arrangement into rows is seen to be dependent upon the course of the fibrils.

No sign of a fibrillar network was found in any sections except in those that had been poorly preserved in sublimate solutions. The distinction between neuroglia and cell tissue is equally, if not more easily determined in these cells than in those of *Helix* and *Arion*, on account of the larger granules which possess no resemblance whatever to fibrils or neuroglia either in structure or reaction to aniline dyes.

The structures mentioned above as characteristic of the nerve cells of Invertebrates, seem to be about the same as those usually described for Vertebrates in

that both consist of fibrils, granules and a ground substance. Although the constitution and arrangement of these elements may be widely different in different species it seems most probable that they are important constituents of all nerve cells in Vertebrates as well as Invertebrates, and are directly connected with the functional activity of the cell.

[Abstract of a paper read before the Princeton Biological Club, March 19, 1896.]

SUMMARIES OF PAPERS PUBLISHED.

THE CLINICAL APPLICATION OF THE ROENTGEN RAYS.

By W. F. MAGIE, W. W. KEEN and E. P. DAVIS.

The investigation herein described was undertaken at the instance of Dr. Davis, '79, editor of the *American Journal of the Medical Sciences*, in order to establish the value of the Roentgen rays in medical and surgical practice. Dr. Keen provided and discussed the surgical cases that were examined; Dr. Davis conducted the work in obstetrics; the physical work was done by Professor Magie.

The paper opens with a description of the apparatus used to generate the Roentgen rays. The peculiarities of a particular tube are described and its efficiency when one of the electrodes was made the cathode and its failure when the others were used is ascribed to the different thickness of the glass walls around the different electrodes. [More recent work would indicate that this cause is not the only nor perhaps the most important reason for the action described.—M.] The existence of a high vacuum is said to be a necessary condition with tubes of the ordinary shape for the efficient production of the rays. An observation is described in which, in a Geissler tube, part of which consisted of a narrow portion of coiled uranium glass tubing, this part was a source of the rays, affecting the fluorescent screen and acting well and with considerable penetration upon a photographic plate. [So far as I know, this observation is unique.—M.] The advantages of the use of a diaphragm of lead, to cut off the action from all but a small part of the tube, are pointed out, for the securing of better definition. [This is now rendered unnecessary by an improved construction of the vacuum tube.—M.] After giving some details of the process of taking a picture (called a *skiagraph*) by the Roentgen rays, an instrument called the *skiascope*, for visual examination of the rays by means of a fluorescent screen is described. [This instrument was invented independently by Salvioni, and conceived though not constructed by E. P. Thompson, of New York, and probably by many others. It is the same instrument as that constructed by Mr. Edison under the name fluoroscope.—M.] Two of the photographers connected with the work observed in one instance, when the photographic plate was taken from the holder, that the object, a boy's arm, appeared as a dark shadow on a lighter ground. This observation points toward a fluorescence of the photographic film under the action of the rays. Three observers, using the skiascope and a sheet of aluminium foil fresh from the shop, observed a distinct increase in the light of the skiascope when the aluminium foil was interposed between it and the vacuum tube. [This action I have not been able to obtain since.—M.]

In the part of the paper devoted to surgery Dr. Keen describes the history of the various cases examined, and the results

obtained by the use of the rays. The plates which accompany the article show anchylosis of the bones of the hand, a tubercular spot in the elbow, an intercondyloid fracture of the humerus, a resected elbow (taken through surgical dressing) and the presence of a needle and bullets placed in the hand of a cadaver.

Dr. Davis' portion of the paper describes the two attempts made, one partially successful, to skiagraph the foetus *in utero*, and various observations made upon infants with the skiascope and the photographic plate.

[Abstract of paper published in The American Journal of the Medical Sciences, March, 1896.]

SOME ASPECTS OF RECENT GERMAN PHILOSOPHY.

By C. W. HODGE.

The aim of the article is, in the main, historical rather than critical. It seeks to give, in as systematic a way as possible, the ideas of some of the most prominent of recent German thinkers.

Three forms of reaction from Hegelianism are discussed. The first is a reaction from Hegel's neglect of science and her categories, to a philosophy which shall be more in touch with the results of scientific research. There has been an attempt to do justice to science, and at the same time to construct a metaphysic with principles of its own. Lotze is cited as showing, in the introduction to his book on metaphysics, that experience cannot be neglected by metaphysics, and also that science has metaphysical presuppositions. The attempt to construct a philosophy in the light of science has taken a theistic and a pantheistic direction On the theistic side Lotze and Ulrici are taken as examples. Lotze's "Metaphysik" is briefly outlined, especially with reference to his theism, and it is sought to show that his system is in unstable equilibrium between pan-cosmism and a-cosmism, because he does not adequately conceive the relation between the Absolute and the Relative. It is shown how Ulrici supplemented Lotze at this point. There is not space to go into this discussion.

The pantheistic side of the tendency to bring philosophy into touch with science, has taken the form of a sort of Spinozism supplemented in the light of modern scientific theories. Spinozism was pure intellectualism, and consequently had no logical place for the ideas of will and energy. It would thus be a closed and lifeless system, hostile to modern science with its doctrine of development or evolution. Philosophy starting with Spinozism must find some way by which to do away with the parallelism of thought and extension in the sphere of the Absolute, leaving it only in the phenomenal sphere, in order that the mechanism of Spinoza be avoided; and at the same time the spiritual side must be conceived as fundamentally volitional in order that the doctrine of evolution be theorized. This phase of thought is well illustrated in Paulsen's "Einleitung in die Philosophie." His ideas are briefly outlined and discussed critically. Haeckel's views, as given in his "Monism," are also discussed as illustrating this same tendency from the standpoint of a scientist who has become a metaphysician.

If, on the objective side, science had been neglected by Hegel, so too on the subjective side had Kant's doctrine of the limit of knowledge been disregarded. This leads to the second form of reaction from Hegelianism, viz.: the return to Kant and reassertion of the Kantian limit of knowledge. Neo-Kantism is therefore taken up as being perhaps the most prominent phase of recent German thought. Neo-Kantism asserts that the "thing in itself" is not a true factor of Kantism, when its spirit is rightly under-

stood. It claims that Kantism means that we must not speak of anything extra-conscious, everything being content of consciousness. The problem of knowledge is the search for the universal rules according to which we ought to think if we would attain truth. Thus the object or content of knowledge is reduced to the formal element in experience. This reduction having been made, Neo-Kantism claims that this formal element should not have ontologic value as with Hegel. Thus, knowledge is subjective and phenomenal. Neo-Kantians may be divided into those who hold that the ideal world of metaphysical reality is indispensable in ethics, and those who believe that it is to be dispensed with practically as well as theoretically. Among the former class are mentioned Windelband and Lange, and among the latter Laas.

A brief digression follows in which two forms of reaction from Neo-Kantism in a more realistic direction, are discussed. Volkelt argues that we must seek in experience for a principle with objective reference, finding it in a "logical necessity" for such reference in the subjective forms of thought. Volkelt's position is briefly discussed, and it is shown how he is finally forced to rest in an intuitive belief, ending in naïve realism. Hartmann's somewhat similar position is also stated, but must be omitted here.

The other form of this reaction from Neo-Kantism is from the side of psychology. Prof. Stumpf in his "Psychologie und Erkenntnisstheorie," shows that the separation of the categories from space and time is impossible; he shows also the impossibility of the separation of form and matter in perception claiming that a spacial element is given in sensation. Kant's doctrine, he claims, conflicts with ascertained results in psychology. He maintains that necessity attaches to the content of certain judgments, and that we get the idea by abstraction from these.

In concluding the discussion of epistemology, a few critical remarks are added. Kant's identification of the form of experience with the subjective process of knowledge is untenable, and separates form and matter unjustifiably. The process is a psychological question, while both form and matter belong to the content of perception and cognition. This, however, does not do away with the fact that ontologically there is a distinction between them, and that the formal elements are the form giving principles which make an objective cosmos possible. Ontologically they are the forms of a universal mind while psychologically they are genetically apprehended. It is concluded that, when all that the psychologist can ask has been granted, the problem of accounting for the universality and necessity of these formal elements remains and this element the psychologist cannot explain. Stumpf's theory of necessity is briefly criticised, and it is concluded that the formal elements cannot be regarded as not differing from the material elements in experience, but that by their necessity and universality they are to be regarded as ontologically different from the material elements.

The third aspect of German thought which is taken up is Pessimism, which arose in Germany as still another form of reaction from Hegelianism, a reaction from his thorough rationalism. Idealism claimed that to know the world I must know my own true innermost self. Hegel removed Kant's limitations, claiming that this self is universal reason, and seeking to deduce from this the world of phenomena. But there is an element of unreason and caprice about the world which could not be adequately dealt with by Hegel. Schopenhauer went to the op-

posite extreme, developing a monistic irrationalism. Pessimism is briefly discussed in reference to its most recent adherents, the modern followers of Schopenhauer, viz.: Frauenstädt, Bahrsen and Deussen.

[Abstract of an article published in the Presbyterian and Reformed Review of April, 1896.]

A CONVENIENT INSTRUMENT FOR VISUAL USE IN DIAGNOSIS WITH THE ROENTGEN RAYS.

By W. F. MAGIE.

The instrument here proposed for examination with the Röntgen rays I have not seen described elsewhere, and therefore present a brief account of it in the hope that it will be of use to investigators in this interesting subject.

A sheet of black paper, coated on one face with platinum-bari cyanide, is placed with the coated side inward across the end of a tube or box, into which the observer looks, and which is so fitted to the face or shielded by cloths that the phosphorescent substance and the eyes are protected from all extraneous light. If this tube be then directed toward the excited Crookes' tube, which is giving the Röntgen rays, the phosphorescent paper in the tube glows, and the shadows of objects interposed between it and the Crookes' tube appear upon it. The advantage of this arrangement consists in its avoiding the experimental inconvenience of working in a dark room, and likewise the delays involved in the plan used by Röntgen. By this instrument the phenomena of the Röntgen rays can be most conveniently investigated. Its obvious applicability in diagnosis has led to my giving an account of it here. A more detailed account, with a report of cases in which it has been used, will appear in the March number of the *American Journal of the Medical Sciences*. (Dated Feb. 7, 1896).

[The Medical News, Feb. 15, 1896.]

PRINCIPLES OF MARINE ZOÖGEOGRAPHY.

By A. E. ORTMANN.

Prof. Theo Gill* has given a very interesting comparison of his own views of zoögeographical division of the earth's surface, especially of the oceans, and those set forth by myself in my 'Grundzüge der Marinen Tiergeographie.' This comparison is the more interesting since we agree in many points with each other. Nevertheless, there are some differences which, as Prof. Gill very properly states, are chiefly due to the different starting points. The discussion is consequently directed at once in a particular direction, and upon this I wish to lay the greatest stress: namely, upon the difference between my method of investigation and that generally employed hitherto. While the method of Professor Gill, and of almost all the other students of zoögeography, is an inductive one, *i. e.*, constructing zoögeographical divisions according to the actual distribution of animals, I make use of the deductive method, considering merely the physical laws that govern the distribution of animals. In what follows I shall state briefly the reasons which have induced me to urge a change in the method of zoögeographical research.

1. Our knowledge of the actual distribution of marine animals is extremely incomplete; we do not know the exact limits of the range of *most* of the species, so that it is impossible at present to get a correct idea of the general features of their distribution, and of the assemblage of the different forms of animals in any particular locality.

2. We cannot derive any divisional limitations of general value from a particular group of animals, since each group is subject to different laws. Thus a division obtained by the study of the prevailing

*Science, N. S. III., No. 66, April 3, 1896, p. 514-516.

conditions in one group is often exactly the opposite of that found to prevail in other groups. From this disagreement arose the continuous dispute between different writers with regard to the number and the limits of the zoögeographieal divisions, each wishing to transfer the results obtained in his favorite group to other groups.

3. The actual distribution of animals is the result of development during the course of the geological history of the earth. While many animals show a distribution which corresponds to the physical conditions of recent times, many others point clearly to conditions of former periods, and their distribution is only intelligible under the supposition that formerly different conditions prevailed on the earth.

Thus we should expect that investigations founded on the actual distribution of animals are in the first place incomplete, and in the second the results obtained are contradictory in many cases. In order to overcome the latter difficulty, statistical lists of the distribution of these animals have been prepared showing which distributional features are most common. But I object even to these statistics. My first reason shows clearly that such statistics never are complete, and it is very dangerous in scicnce to rely upon statistics deficient in the main quality by means of which they are useful at all.

From these considerations I am induced to use the deductive method, and to construct zoögeographical divisions according to the differences in the physical conditions influencing the distribution of animals. But I remark expressly, I do not regard such a division of the earth as the final aim that should be reached in zoögeography, but only as a means which facilitates zoögeographical study. My divisions represent only *a rough sketch of the distribution of the different conditions of life in recent time.* Of course, these divisions do not agree with those assigned to animals the range of which is due to conditions belonging to former times; but even in such cases my divisions have a decided advantage. If there are any exceptions in the actual distribution of certain forms we see at once that these animals do not follow the general rules according to which the divisions are conceived, and the knowledge that certain laws do *not* control particular cases is a considerable advantage in revealing the true causes of these peculiarities. For the whole point or aim of zoögeographical research is to find out the *causes of the distribution* of each animal form.

The above reasons, I think, are sufficient to demonstrate that my starting point has certain advantages over that of other students in zoögeography. Notwithstanding the results of my investigations are very similar to these obtained by Professor Gill. This is due, I believe, to the extensive and correct character of his preliminary work, to the exact and fundamental study of the actual distribution of certain groups of animals, and to the full use he has made of the known facts. On the other hand, I think, Professor Gill's method is not so fundamentally different from mine as it seems to be perhaps according to his own statement. It is true he 'prefers the inductive method' (p. 515), and his divisions are adapted in some degree to the actual distribution of certain animals; nevertheless his chief marine divisions are conceived according to a *physical* principle, to the *temperature* of the ocean waters, a principle which was first introdueed by Dana, and the importance of which is recognized by Professor Gill in the concise sentence: "Temperature is a prime factor, and land a secondary, in the distribution of marine animals."* On this point our opinions agree completely, and

*Presidential Address Biol. Soc., Washington, Jan. 19, 1883, p. 89.

thus, I think, our starting points are not so extremely different, since Professor Gill in constructing his zoögeographical divisions of the seas pays due attention to temperature, which is at least one, and indeed the most important, physical factor.

With regard to the objections of Professor Gill to my life districts, I should like to add here that I do not fully understand why he says they are misconceived, since they are framed in contravention of my own principle of continuity. If all the life districts were continuous, any further divisions would be impossible and needless, as is the case in the abyssal (bassalian) district, and even the discontinuity of the others obliges us to make further divisions so as finally to reach continuous and consistent areal units. I formed my division into life districts according to the primary conditions of life, and I never claimed that all the localities on the earth showing the same primary conditions of life should be continuous; I only claimed that the smallest areal units of zoögeographical division should be continuous. Different conditions of life have existed since the beginning of the geological history of the earth; the secondary divisions into regions of the marine life districts, which were formerly continuous in a greater or less degree, are made according to the topographical continuity, which was interrupted by the introduction of climatic differences in much later times. The assigned districts of life are old, and during a long time they were the only zoögeographical divisions of the seas. The different regions of the life districts themselves are of a comparatively recent date, and their existence did not begin until a differentiation of climate took place.

Professor Gill further suggests that the life districts themselves are of unequal value, and they should be segregated into two primary categories, marine and inland. I agree perfectly with this view, as the same view is maintained in my book, the title of which reads: 'Principles of *marine* zoögeography,' thus leaving out of view the consideration of *inland* districts. Further, I expressly state (p. 18–20) that the diagnostic value of my five life districts differs, for if we were to establish a perfectly philosophical division we should have to introduce other districts, but only the *five* named are of *practical* value. The fact that the marine life districts are unequal as regards the number of subdivisions I cannot consider as an objection to their correctness. Indeed, in this respect they *are* unequal, but if they are unequal in nature why should we try to correct nature in proposing a scheme on paper in which the divisions would appear more equal than they really are?

I am glad that Professor Gill by his remarks has given me an occasion to state again in a concise form my reasons for neglecting the inductive or statistical method in zoögeography. I think that practical results favor my method, especially since there is a remarkable parallelism in both divisions, Professor Gill's and mine. This fact suggests that an agreement of both is at least possible, and then, perhaps, some of the scientific terms of Professor Gill would have the priority and should be used, as most of the terms used by me are certainly in that particular sense of more recent date.

Paper published in *Science*, May 15th, 1896.

AUTOMATISM IN MORALITY.

By JOHN GRIER HIBBEN.

An examination of certain ethical theories of the evolutional school, especially the articles of Pioger and Paulhan in the *Revue Philosophique* of 1894. The following positions are stated and criticised:—

1. That there is an unbroken uniformity in the line of development from the lowest order of animals, which manifest rudi-

mentary social instincts, to the highest forms of morality in civilized man.

2. That the development of morality and of society have followed parallel lines throughout their history.

3. That moral practices came before any reflection, or consciousness of moral law or obligation.

4. That conscience may possess an organic or functional character, forming an integral part of social organism, and that according to Pioger the genesis of a social conscience is explained by a differentiation of the nervous system especially adapted to the reception of social excitations, just as the sense of sight arises from a nervous differentiation peculiarly adapted to the reception of luminous vibrations.

5. That individual conduct, apart from its social relations, has no moral significance.

6. That conscious morality is the exception as regards the conduct of mankind generally, and that any consideration of law, obligation, etc., tends to disturb the normal workings of instinctive habits.

The purpose of the paper is to prove, in opposition to the above propositions, that there is in consciousness that to which in the last analysis we are constrained to appeal,—a feeling of superiority to the sensible series of time and space in its perpetual flux, a something within transcending the phenomena of which we are a part. This feeling has psychological reality of an unusual character, and as such it can not be ignored. This alone explains what without it must remain a paradox—namely, that in the midst of the pleasure-pain phenomena, whose summation is supposed to embrace the totality of existence, we see a person enduring pain, scorning the allurements of pleasure, suffering and choosing to suffer rather than to relinquish his ideal. It is that which renders us dissatisfied, even when driven by desire to the full fruition of our wants; for there is ever a higher within us which is not satisfied when the lower is appeased. Shame, disgust and regret, which follow the unrestrained gratification of appetite or passion, are indications that the real self is asserting its claims for higher gratification. It is the divine restlessness of the human soul. In it we feel the stirring of our distinct self-hood, and a conviction that beneath the stream of phenomenal self-manifestations there is indeed a "buried life" of enduring personality.

Paper published in the *International Journal of Ethics*, July, 1895.

ON THE THEORY OF THE EXISTENCE OF CLIMATIC ZONES IN JURASSIC TIMES.

By ARNOLD E. ORTMANN.

The theory of M. Neumayr, that climatic zones were present in the seas of the Jurassic period, although much discussed at first and opposed, was subsequently accepted almost generally by geologists, and has been considered sufficiently established so as to be admitted to many text-books of geology. In the pursuance of zoögeographical studies I have been obliged to examine this theory more closely, since it bears very importantly on the origin of the zoögeographical divisions of the earth; and after a careful perusal of all the writings of Neumayr relating to the subject, I am convinced that this theory is entirely untenable; in fact, it is so poorly supported, that it seems almost surprising that nobody has called attention to the grave errors contained in it before this.

Neumayr was induced to propound his theory on account of the differences actually existing in the faunas of the Jurassic strata of different localities in Europe. By means of these differences he dis-

tinguishes a *Mediterranean* province comprising the Jurassic deposits of Southern Europe; a *Middle-European* province, comprising those of England, France, Germany, Poland, and a *Boreal* or *Russian* province, comprising those of Russia. The differences presented in these provinces, may be due either to *topographical* or to *climatic* causes; these consist in the separation of the respective sea-basins by land; or in differences in the depths of the seas, or in the petrographic characters of the deposits (facies). Neumayr believing that he has demonstrated that the action of these topographical causes is impossible, concludes that the only way left for an explanation of the faunistic differences is to suppose the existence of climatic differences. This supposition is supported, he alleges, by the geographical distribution of the faunas characteristic for each of these provinces, they are distributed in circumpolar zones all around the earth.

The principal objections I make to this theory are of two kinds. In the first place, I maintain that Neumayr did not show the impossibility of the action of topographical causes, and in the second place, I do not grant, that the alleged circumpolar arrangement of the different provinces exists at all. Besides, there are a number of additional arguments which seem to be very much against this theory.

As regards the topographical causes, Neumayr demonstrates only, that a separation of the Jurassic seas of Europe by land did not exist. This demonstration I consider to be correct, and make no objection to it. But as regards the other points, Neumayr's argument is a complete failure, since he touches the matter only superficially and does not give it proper and thorough consideration. While discussing the differences of the Mediterranean and Middle-European provinces, he concedes that the depths of the respective seas were different, and that the strata of the former were deposited in deep water, the latter in shallow water. He says, however, that these differences of depth cannot be held responsible for the differences in the faunas, since in some typical Mediterranean Cephalopod-beds, Reef-Corals are present, and Reef-Corals indicate shallow water. The locality where this peculiar mixture of the fauna occurs (Stramberg, Moravia) has not been discussed carefully by Neumayr, although this seems quite indispensable in order to derive any proper conclusions from it. The simple fact that corals and Mediterranean Cephalopods are found in the same beds is sufficient to cause Neumayr to reject the idea of the influence of the depth of the sea upon the fauna, which is otherwise—according to himself—very seductive. But investigating the matter more closely, I have been convinced that these beds were deposited in deep water, close to a steep precipice, where in the upper level, in shallow water, Coral-Reefs flourished; Coral-fragments rolled down into the Cephalopod-beds and thus a mixture of shallow water and deep water fossils has been effected. The petrographic character of the Stramberg-limestone as well as its geographic situation fully supports this view. Thus the only objection, quoted by Neumayr, to the action of the differences of depth of the seas is set aside.

Concerning the differences of the facies, Neumayr does not even try to give any proof, that the faunistic differences are *not* due to the peculiarities of the deposits found in the three provinces. He alleges, it is true, that "grave doubts exist" against the supposition, that the faunas are influenced by the well-known differences of the facies; but he does not name any one of these doubts, and therefore this statement is rather arbitrary. Differences in the facies are certainly present, especi-

ally between the Middle-European and the Russian Jura, and they may be generally characterized by stating the prevalence of calcareous deposits in the former and of arenaceous in the latter. Such differences must have influenced the respective faunas, and although Neumayr alleges the contrary, this allegation is not fully supported.

In my opinion, even these two points, the depth of the seas and the differences in the facies, are the causes producing the faunistic differences, and further, we must believe that the Mediterranean Jura was deposited at considerable depths, while the Middle-European and the Russian was formed in shallow water; in the Middle-European Jura, limestone-facies prevail, in the Russian sandy facies, and the faunas found in the respective beds are different accordingly.

The weakest point in Neumayr's views is the alleged circumpolar distribution of the three provinces. Neumayr himself is acquainted with the facts which are opposed to his theory, and latterly similar facts have been discovered. At present many cases are known of the occurrence of deposits characteristic of a particular climatic zone in regions where they would not be expected according to Neumayr's theory. I need mention merely the presence of deposits showing a Middle-European character in tropical East Africa, and of Boreal deposits in California and Mexico. These examples are amply sufficient to disprove Neumayr's theory; since it is evident that deposits said to be formed in a temperate or boreal climate should not be met with in the tropics.

I shall consider only two of the additional objections to the existence of climatic zones in Jurassic times.

Of all the groups of living animals which are found also in a fossil state, none enables us to conjecture as to the former climatic conditions with such confidence as the Reef-Corals. Reef-Corals it is true, are very rare in Russia, but no doubt, this peculiarity is due to the prevailing facies; they are present nevertheless even in Russia, wherever calcareous deposits are developed. Therefore, the so-called "borcal" seas of Neumayr must have possessed a tropical climate. Neumayr pays no attention to this fact, although it has been vigorously pointed out by Nikitin.

Further, the climatic conditions of Post Jurassic times were decidedly warmer than those of the Jurassic time as accepted by Neumayr. According to him during the Jurassic period a temperate or even boreal climate prevailed over the greater part of Europe. We know on the other hand, that in the earlier Tertiary period a tropical or a subtropical climate existed in Europe and even in more northern localities. Thus, if we accept Neumayr's theory, we are forced to believe that the climatic differentiation of the earth was farther advanced in the Jurassic than in Tertiary time; this is absolutely impossible according to the generally accepted theory of the gradual cooling of the earth.

The above are the chief objections to Neumayr's theory, and it is evident that its very foundations are insufficiently established. The differences in the Jurassic faunas are due to topographical causes, such as the depth of the seas and the different character of the facies. No traces are present of a climatic differentiation and we must suppose, that the Jurassic ocean all over the earth possessed temperature conditions which might be properly compared with those prevailing in the tropical seas of recent times. There was a high average temperature and the changes of temperature were only small. A climatic differentiation of the ocean did not exist until the beginning of the Tertiary period.

[Summary of a paper published in the *American Journal of Science*, April, 1896.]

BOOK REVIEW.

Inductive Logic, by John Grier Hibben, Ph. D., Assistant Professor of Logic in Princeton University. New York: Chas. Scribner's Sons, 1896.

This neat little volume is the fruit of Professor Hibben's effort to bring the materials of induction into a form and compass that will meet the requirements of a manual of elementary instruction in the class-room. It is meant to serve as a fitting supplement to the elementary courses in formal or deductive logic. The fact that most of the premises of deductive reasoning are obtained by observation and investigation shows the close dependence of deduction on the inductive processes. The author has, therefore, emphasized the necessity of a thorough knowledge of the principles of induction as a condition of an intelligent grasp of the nature of inference in general. He also contends for the correlation of the two methods, regarding induction and deduction as mutually dependent and in fact as phases of one and the same logical procedure.

This is the modern tendency as distinguished from the habit of the older logicians which was to regard the two methods as distinct if not antagonistic, and in embodying it in his treatise Professor Hibben puts himself in line with the best logical thought of the time. Starting out in substantial agreement with the great work of Mill, sympathy with which seems to be almost a *conditio sine qua non* of fruitful work in this field, Professor Hibben's own position as an inductive thinker might be characterized as that of an adherent of Mill, whose views have been qualified at various points by study of the work of Mill's contemporaries, Whewell and Jevons, as well as by the important new developments in logical science embodied in the works of such writers as Lotze, Sigwart, Green, Bradley, Bosanquet and Venn. While the nature of the subject and the limits of an elementary discussion leave small room for originality, the author has handled his materials in an independent spirit and has produced a work that combines careful scholarship and discriminating judgment in dealing with the problems of induction and in the selection and arrangement of materials, with clearness of definition and statement.

The first six chapters treating of The Nature of Inference, Induction and Deduction, The Essentials of Induction, Types of Inductive Inference, Causation, and Causal Analysis and Determination, are devoted to a statement of the groundwork and principles of induction. The next five chapters treat of the inductive methods of investigation as laid down by Mill. Then follow chapters on Verification and Prediction, Hypothesis, Analogy, Probability and Empirical Laws. Fallacies are treated under four heads, Errors of Perception, Judgment, Imagination and of the Conceptional Process. Then follows a discussion of the inductive methods as applied to the various sciences and a sketch of the history of induction from Socrates to Mill. The book closes with an interesting and valuable collection of practical examples selected from the writings of the leading investigators of modern times. This is a feature of the work which distinguishes it from other manuals on induction and gives it a decided advantage for text-book purposes. A notable feature of Professor Hibben's treatise is the way in which the theoretical and practical demands are kept constantly in view. It is in one point of view a compact and clear statement of inductive theory, in another, a treasure-house of facts and illustrations.

The work is neatly printed, convenient in size and contains a good table of contents and an index. A. T. Ormond.

NOTES.

The Department of Civil Engineering of the College has recently received a gift oftwo models representing the Eads' Jetties at the mouth of the Mississippi River. Each one of these models is three inches thick, ten inches wide and forty-three inches long. The first representing the results of surveys and soundings made in May, 1875, shows the South Pass as it was before the works were begun, with a maximum depth of nine feet over the bar at the Gulf end of the Pass. The second, of April, 1878, shows the jetties as they were constructed and the effect that they had caused in scouring out a channel about thirty feet deep from the deep water of the river through the bar to the deep water of the Gulf. Incidentally they illustrate very clearly the process of land-making at the mouths of silt-laden streams.

These models were made under the direct supervision of Captain James B. Eads in 1878, just before the final completion of the work. They are the gift of Mr. Max E. Schmidt, M. Am. Soc. C. E., who was the chief assistant engineer during the construction of this important undertaking.

ADVERTISEMENTS.

Princeton College Bulletin.

EDITED BY THE PRESIDENT AND MEMBERS OF THE FACULTY.

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PUBLIC LECTURES DELIVERED AT PRINCETON UNIVERSITY IN CONNECTION WITH THE SESQUICENTENNIAL CELEBRATION IN OCTOBER, 1896.

I.

Four lectures by Joseph John Thomson, Cavendish Professor of Physics in the University of Cambridge, England. Subject: The Discharge of Electricity in Gases. These lectures were delivered in the Physical Lecture-room of the John C. Green School of Science.

II.

Four lectures by Felix Klein, Professor of Mathematics in the University of Göttingen, Germany. Subject: The Mathematical Theory of the Top. These Colloquia were held in the Physical Lecture Room.

III.

Six lectures by Edward Dowden, Professor of English Literature and Rhetoric in Trinity College, Dublin. Subject: The French Revolution and English Literature. These lectures were delivered in Alexander Hall.

First lecture: The Revolutionary Spirit before the Revolution.

Second lecture: Theorists of the Revolution: William Goodwin and Mary Wollstonecraft.

Third lecture: Anti-revolution: Edmund Burke.

Fourth lecture: Early Revolutionary group and antagonists: Southey: Coleridge: the Anti-Jacobin.

Fifth lecture: Recovery and Reaction: Wordsworth.

Sixth lecture: Renewed Revolutionary Advance: Byron: Moore: Shelley.

IV.

Two lectures by Andrew Seth, Professor of Logic and Metaphysics in the University of Edinburgh, Scotland. Subject: Theism. The lectures were delivered in Alexander Hall.

V.

One lecture by Karl Brugmann, Professor of Indogermanic Philology in the University of Leipsic, Germany. Subject: The Nature and Origin of the Noun Genders in the Indogermanic Languages (Ueber Wesen und Ursprung der Geschlechtsunterscheidung bei den Nomina der indogermanischen Sprache.) This lecture was delivered in German in the English Room, Dickinson Hall.

VI.

One lecture by A. A. W. Hubrecht, Professor of Zoölogy in the University of Utrecht, Holland. Subject: The Descent of the Primates. This lecture was delivered in the Geological Lecture-room in Nassau Hall.

PROFESSOR GREEN'S JUBILEE.

In accordance with a resolution adopted by the Board of Directors of Princeton Seminary, October 8, 1895, the fiftieth anniversary of the appointment of Professor William Henry Green as an instructor in the Seminary was celebrated in Princeton on May 5th of the present year. What may well be termed the most notable Commencement Day in the history of the Seminary began with the usual graduation exercises in Miller Chapel. These were followed by a brief meeting of the Alumni Association. Upon its adjournment a procession formed in the Seminary campus under the marshalship of Professor Libbey of the College, and marched in the following order to Alexander Hall:

Presiding Officers.
Representatives of other Institutions.
Directors of the Seminary.
Trustees of the Seminary.
Speakers of the Day.
Faculty of the Seminary.
Trustees and Faculty of the College.
Invited Guests.
Alumni of the Seminary by Classes.
Graduating Class.
Undergraduates.

Dr. Green met the procession in the Hall and all remained standing until he had taken his seat at the right of the presiding officer, the Rev. Abraham Gosman, D.D., President of the Board of Directors. After the singing of the hymn, "I Love Thy Kingdom, Lord," prayer was offered by Professor John G. Lansing, D.D., of the New Brunswick Theological Seminary. The opening address was then made by Dr. Gosman, to whom had been assigned the subject, "Dr. Green's Services to the Seminary." He was followed by Professor Charles M. Mead, of the Hartford Theological Seminary, whose theme was "Dr. Green's Contribution to Biblical Criticism." Dr. Mead gave a detailed and complete account of Dr. Green's position as to matters in controversy in the field of Biblical Criticism, and of the enormous amount of work he has done in the chosen sphere of his special studies. He traced his literary career from the early articles contributed to the *Princeton Review* nearly fifty years ago to his latest book, then fresh from the press, "The Unity of Genesis."

Dr. Mead was followed by Professor James F. McCurdy, LL.D., of University College, Toronto, who spoke of "Dr. Green's Contribution to Semitic Scholarship." Dr. McCurdy noted three eras in the study of Hebrew in Princeton Seminary, the first having been introduced by Charles Hodge, the second connected with the brilliant labors of Addison Alexander, and the third that of Dr. Green's thorough and fruitful work. He described Dr. Green as the greatest living Hebrew teacher in America, the most influential Hebrew teacher of his time among English-speaking men.

When Dr. McCurdy had finished, the chairman introduced President Patton, whose subject was "Dr. Green's Services to the Church at Large." He spoke of Dr. Green as a thorough, pains-taking scholar, who had narrowed his sphere of labor and thereby widened his influence; as a great teacher, a great scholar and a great defender of the faith, who has not stopped to ask, "What would happen if the critics were right?" but has addressed himself to the stupendous task of proving that the critics were wrong. This Dr. Patton regarded as Dr. Green's greatest service to the church.

At this point Dr. Green came forward to acknowledge the compliment paid him and the institution which he represented, when the entire audience rose to its feet and remained standing until he begged them to be seated. In his brief reply, Dr. Green assured his audience that Princeton Seminary stood where it had always stood,

for fidelity to the word of God; he referred to himself as the only remaining link between the first professors and the present Faculty.

There then followed six congratulatory addresses: by the Rev. Robert R. Booth, D.D., LL.D., Moderator of the General Assembly, who represented the Presbyterian Church; by Professor William M. MePheeters, of Columbia Theological Seminary, who brought greetings from Our Sister Churches; by Professor Willis J. Beecher, D.D., of Auburn Theological Seminary, with greetings from Our Sister Seminaries; by President Ethelbert D. Warfield, LL.D., of Lafayette College, representing Dr. Green's Alma Mater; by Henry M. Alexander, LL.D., of New York City, representing the Board of Trustees of Princeton College, and by Professor Howard Osgood, D.D., LL.D., one of the few surviving members of the American section of the Old Testament Revision Committee, of which Dr. Green was the chairman.

At the conclusion of the congratulatory addresses the Rev. Dr. W. E. Schenck, Secretary of the Board of Directors, referred to the large number and warm tenor of the replies received from those who could not attend the celebration. It had been intended to have some of these read, but time failed. Dean Murray, on behalf of the Board of Trustees of the Seminary, here made the announcement that it was proposed to mark in an enduring way the completion of Dr. Green's fifty years of service by the raising of one hundred thousand dollars for the endowment of a William Henry Green Memorial Professorship of Semitic Languages. The exercises of the morning were closed by the benediction pronounced by the Rev. John H. Munro, D.D., pastor of the Central Presbyterian Church of Philadelphia, of which Dr. Green was at one time pastor.

After the alumni dinner in University Hall the alumni and guests returned to Alexander Hall, where the after-dinner speeches were made, the Rev. Dr. Schenck, President of the Alumni Association, presiding. The following toasts were responded to: The Father of the Man, by the Rev. William C. Cattell, D.D., LL.D., of the class of 1852; Our Fellow Student, by the Rev. Theodore L. Cuyler, D.D., of the class of 1846; The Young Professor, by the Rev. A. A. E. Taylor, D.D., LL.D., of the class of 1857; The Established Teacher, by Dean Edward H. Griffin, D.D., LL.D., of the class of 1866; The Learned Doctor, by the Rev. John Fox, D.D., of the class of 1876; and The Head of the Faculty, by Professor William M. Paxton, D.D., LL.D., of the class of 1848, and in seniority the next member of the Faculty to Dr. Green. The celebration was closed by the benediction pronounced by Canon Arthur J. Mason, D.D., Lady Margaret Professor of Divinity in Cambridge University, England. The public exercises were followed by a reception given by Professor and Mrs. Green in their home on Stockton Street, which was very largely attended. The celebration was attended by many distinguished educators and Semitic scholars, as well as by a large number of Dr. Green's former pupils, and was a fitting tribute to his eminent services as a teacher and scholar.

ORIGINAL CONTRIBUTIONS.

THE FREEZING POINT OF DILUTE AQUEOUS SOLUTIONS.

By E. H. LOOMIS.

The following measurements were made during the winter months of 1895-96 in the Physical Laboratory of Princeton University. The conditions under which the work was done were the same as during the preceding period of observation (winter 1894-5), except that the lower and more nearly uniform temperature throughout the past winter made the maintenance of the room-temperature at about 3°C. much easier. In fact the room-temperature rarely varied more than 0.°5C. during an entire day.

This constancy of temperature has reduced the experimental error to about one-half its former value, as appears from the fact that the average variation in a series of five entirely distinct and independent observations of the freezing point of a given solution is now 0.°0005C., while its former value was about 0.°0010C.

That the experimental errors are considerably lowered by this increased constancy of the room-temperature appears also in the fact that the successive observations of the freezing point of water present less irregularity than in the previous work.

This reduction of experimental error accounts for the greater regularity in the course of molecular depressions in the region of extreme dilution, as compared with the similar curves for the previous results.

There seems to be no doubt that this lowering of the experimental error is due wholly to the greater constancy of the temperature of the mercury thread in the projecting stem of the thermometer.

I think it is now more probable than ever before, that a final degree of accuracy is to be looked for only under the condition of absolute constancy of the room temperature at 0°C. On such days as permitted a close approach to this condition I found the various manipulations were much more easily made and the different measurements more nearly approached exact concordance.

It has not been found necessary to make the slightest change in the apparatus or method and the measurements here to be submitted may thus be regarded as a continuation of those of the preceding winter (1894-95).

The present series of observations comprise the following compounds:

Li Cl, Ca Cl_2, Sr Cl_2, Sn Cl_4,

NNO_3, KOH, NaOH,

KH_2PO_4, Na_2HPO_4, $Na(NH_4)HPO_4$, Na_3PO_4 $Na_2Si\,O_3$,

Acetic, Oxalic, Succinic, Tartaric and Citric Acids.

Methyl Alcohol, Glucose and Glycerine.

In addition to the above complete series of measurements, the former observations on NaCl, KCl, NH_4Cl and $BaCl_2$ were extended so as to include the more concentrated solutions; $m = 0.50$ and $m = 0.70$ respectively.

The following tables present the results for the chlorides. In column (1) is found the strength of the solutions in gram-molecules per liter, in (2) and (3) the observed depression and the molecular depression respectively, while in (4) is found the difference between the observed depression and that required by the hypothesis of van't Hoff and Arrhenius.

Discussion of the Chlorides.

1. It will be remembered that a very striking fact was presented in the molecular depressions of the freezing point by HCl and $MgCl_2$, as was indicated in the author's account of observations on these compounds*, namely the fact that the molecular depression for each of these

*Phys. Review, III, p. 281.

Lithium Chloride.

1 Gram-Mol. per liter of Solution. (m)	2 Depression of Freezing Point. (Δ)	3 Molecular Depression of F. P. $\frac{\Delta}{m}$	4 Difference Δth.-Δexp.
0.0099	0°.0363	3.67	-0°.0005
0.0198	0 .0710	3.59	0 .0004
0.0496	0 .1770	3.57	0 .004
0.0992	0 .3520	3.55	0 .013
0.1983	0 .7018	3.54	0 .039
0.4959	1 .809	3.65	0 .228

Calcium Chloride.

0.0100	0°.0513	5.13	-0°.0003
0.0201	0 .1013	5.04	0 .0013
0.0502	0 .2437	4.85	0 .006
0.1004	0 .4823	4.80	0 .022
0.2008	0 .9718	4.84	0 .090
0.5021	2 .605	5.19	0 .555

Stontium Chloride.

0.0100	0°.0508	5.08	-0°.0013
0.0199	0 .1015	5.10	0 .0049
0.0499	0 .2445	4.90	0 .011
0.0997	0 .4834	4.85	0 .031
0.1994	0 .9608	4.82	0 .099
0.4986	2 .532	5.08	0 .543

Tin Chloride ($Sn Cl_4$).

0.01	0°.1261	12.61	
0.02	0 .2487	12.44	
0.05	0 .5973	11.95	
0.10	1 .1457	11.46	
0.20	1 .968	9.84	

Compound.	m	Δ	$\frac{\Delta}{m}$
NaCl	0.70	2°.394	3.43
KCl	0.70	2 .346	3.35
NH_4Cl	0.70	2 .384	3.41
$BaCl_2$	0.50	2. 412	4.83

compounds reached a pronounced minimum at about m = 0.10. It now appears from the present measurements that *all* the chlorides thus far examined, that of Tin excepted, manifest this same minimum, though in the case of NH_4Cl, NaCl, and KCl it is much less pronounced.

It is to be remarked that Arrhenius' observations on these chlorides quite generally exhibit this minimum value. Since these early observations lay no claim to a degree of exactness attained in the later methods it is the more surprising that they so plainly reveal the existence of these minimum values which characterize the chlorides. Although Arrhenius called no attention to them and evidently believed they were due to experimental errors, it is still difficult to understand why subsequent observers with preciser methods should have failed to find them. The existence of this minimum value in the case of the binary chlorides may be easily demonstrated with an ordinary $\frac{1}{10}°$ thermometer and beaker glass.

2. The division of the compounds into two groups, one containing univalent radicals, as LiCl, the other containing bivalent radicals, as $Ca Cl_2$, is confirmed by the new results here presented. The characteristics of these two groups, as found in the former work, remain unaffected by the addition of this new material.

3. There is no evidence in any of the chlorides or any other of the compounds examined of any break in the regular course of molecular depressions, save in the region of extreme dilution, where they are so small as to be best explained by experimental errors. It may be safely said, now that I have examined about thirty-five characteristic compounds, that the existence of definite "Hydrates" at particular concentrations is not indicated by the changes in the freezing point which attend changes in the dilution of the solution.

4. An examination of the differences exhibited in column (4) reveals a most striking agreement between the experimental results and the theoretical values. This agreement is practically complete in the region of the most dilute solutions, and the assumption is warranted that in

"ideal" or "infinitely" dilute solutions the agreement would be perfect, and it is to be remembered that it is exactly in this region of extreme dilution that the van't Hoff and Arrhenius hypotheses are to be tested.

The case of Tin Chloride needs separate discussion.

First, it is to be observed that the depressions are much more than *twice* as large as those produced by any other chloride in the same concentration. It is impossible to compute what the theoretical value of the depression should be on the basis of the dissociation theory, since measurements on the conductivity of these solutions are wanting. It is, however, a striking fact that if it be assumed that the salt at the concentration m=0.01 be *completely* dissociated, and that each molecule splits up into five parts, Sn–Cl–Cl–Cl–Cl, we would have for the value of the molecular depression only 5×1.89 or 9.45, while the observed value is 12.61. Obviously, the depression is not to be explained in this way. It however suggests itself that perhaps the *$SnCl_4$ does not exist at all in aqueous solutions*, but that it assumes at once the properties of a mixture of $SnCl_2$ and 2HCl in solution. No value for the depression of the freezing point by $SnCl_2$ has been found, but assuming that it is about that of $CdCl_2$ and $ZnCl_2$ as observed by Jones*, *i. e.*, 5.2, and taking the observed value for HCl, *i. e.*, 3.61, we have for the depression due to $SnCl_4$, 5.20+2(3.61) or 12.44. This is very nearly the observed value.

It should be said that many attempts were made to prepare solutions of $SnCl_2$ sufficiently free from $SnCl_4$ to allow the freezing points to be measured. The purpose was to measure the depressions in a solution of $SnCl_2$ at m=0.01, and then add in succession a $\frac{1}{100}$ gram-molecule of HCl. Thus measurement would be made on

$SnCl_2$	m=0.01
$SnCl_2$+1HCl	m=0.01
$SnCl_2$+2HCl	m=0.01
$SnCl_2$+3HCl	m=0.01

as was done in the cases of the phosphates p. (591). This would have decided experimentally whether the suggestion just made in regard to the nature of $SnCl_4$ in solution is tenable. I hope to return to this difficulty in the near future. It may be well to call attention here to the great importance of exact measurements of the conductivity of this salt together with that of the various phosphates and the dilute solutions of $MgCl_2$ and NH_4NO_3 for the purpose of obtaining experimental values for the "degree of dissociation," $\frac{\mu_\infty}{\mu_x}$

The Sodium and Potassium Hydroxides, Nitric Acid and Sodium Silicate.

POTASSIUM HYDROXIDE.

1 m	2 Δ	3 $\frac{\Delta}{m}$	4 $\Delta_{th}-\Delta_{ex}$
0.01	0°.0343	3.43	+ 0°.0028
0.02	0 .0689	3.45	0 .0049
0.05	0 .1719	3.44	0 .0106
0.10	0 .3426	3.43	0 .017
0.20	0 .6860	3.43	0 .028
	SODIUM HYDROXIDE.		
0.01	0°.0328	3.28 (?)	+ 0°.0038
0.02	0 .0691	3.46	0 .0033
0.05	0 .1727	3.45	0 .0038
0.10	0 .3414	3.41	0 .0039
0.20	0 .6814	3.41	0 .0015
	NITRIC ACID.		
0.01	0°.0350	3.50	+ 0°.0023
0.02	0 .0712	3.56	. . . .
0.03	0 .1059	3.53	0 .0048
0.05	0 .1754	3.51	0 .0081
0.10	0 .3496	3.50	0 .013
0.20	0 .6959	3.48	0 .020
	SODIUM SILICATE.		
0.0105	0°.0676	6.46	
0.0209	0 .1339	6.41	
0.0523	0 .3068	5.87	No data.
0.1046	0 .5533	5.29	
0.2092	0 .9785	4.68	
0.5230	2 .087	3.99	

*Jones, Zeit. Phys. Chem. XI, p. 328.

It is to be observed that the molecular depression for KOH, NaOH and HNO_3 as exhibited in column (3) varies very little with the concentration, as has been found also to be the case with HCl.

It is to be noted that the values for m= 0.01 in each instance here are evidently too low and indicate experimental errors, which reach, at least in the case of nitric acid, 0°.0004. The value for NaOH, m= 0.01, I am unable to explain. The measurements were twice repeated, making in all 13 entirely distinct observations on this solution. The average of all was 0°.0325. The value 0°.0328 belongs to the same series to which the other measurements belong and for this reason was taken. The error, consequently, can not be referred to the possible errors of observation. It seems to be connected in some way with the solution.

It is also difficult to believe that the conversion of the NaOH and KOH into the carbonates by the CO_2 of the air would be sufficient to account for this marked irregularity and for the seemingly low values throughout this region of greater dilution. The present method permits no experimental answer to this question.

Sodium Silicate.

The molecular depressions are very great, and the rate of decrease with increase in concentration, as in the case of $Sn\,Cl_4$, is enormous. Thus, while it is 6.46 at m= 0.0105, it has fallen to 3.99 at m=0.523.

It is not without interest to note that the complete dissociation of this salt in the solution m=0.0105, provided each molecule splits into three parts after the analogy of $Na_2\,SO_4$, would still require the theoretical value to be only 3×1.89 or 5.67, which is much less than the observed value. It seems probable that as in the case of $Sn\,Cl_4$ the aqueous solution of $Na_2\,SiO_4$ has the properties of a mixture of NaOH and SiO_2 where the presence of the SiO_2 seems to lessen the degree of dissociation of the NaOH. The observations of Kohlrausch on the electrical conducivity of this salt seem to point to the same conclusion.

This point should secure a more careful study than I have thus far been able to give to it.

Potassium di-Hydrogen Phosphate, Di-Sodium Hydrogen Phosphate, Microcosmic Salt, and Tri-Sodium Phosphate.

KH_2PO_4			Na_2HPO_4		
1	2	3	1	2	3
m	Δ	$\frac{\Delta}{m}$	m	Δ	$\frac{\Delta}{m}$
0.01	0.0358	3.58	0.01	0.0499	4.99
0.02	0.0760	3.60	0 02	0.0969	4.85
0.05	0.1740	3.48	0.05	0.2304	4.61
0.00	0.3865	3.37	0.10	0.4345	4.45
0.00	0.6434	3.22	0.20	Beyond limit of solubility at O°C.	
$Na(NH_4)HPO_4$			Na_3PO_4 (?)		
0.01	0.0495	4.95	0.01	0.0715	7.15
0.02	0.0856	4.79	0.02	0.1369	6.85
0.05	0.2260	4.52	0.05	0.3048	6.10
0.10	0.4242	4.24	0.10	0.5661	5.56
0.50	0.7817	3.91	0.20	Not observed.	

Discussion of Results for the Phosphates.

It has been found in previous work that the depressions of the freezing point caused by phosphoric acid, H_3PO_4, are much lower than those caused by the groups of compounds, containing univalent and bivalent radicals, and this is the more surprising since phosphoric acid contains a trivalent radical. For the purpose of examining into this matter more closely I undertook to measure the freezing points of the present series of phosphates.

1. The first fact which appears from the results is that these phosphates are entirely unlike the phosphoric acid and differ still more among themselves.

2. *In proportion as the hydrogen of phosphoric acid is replaced by metallic atoms the depression of the freezing point is increased.*

3. If we assume that in the case of H_3PO_4 the molecule splits up into H and H_2PO_4 we may calculate the freezing points on the basis of the dissociation theory.

The theoretical values so obtained are given in column (4), while in (2) are found the observed values taken from former measurements. The agreement here exhibited makes our assumption fairly probable that in the process of dissociation only a single atom of hydrogen is "split off."

H_3PO_4

1	2	3	4	5
m	Δ	$\frac{\Delta}{m}$	Δ_{th}	$\Delta_{th}-\Delta_{exp}$ +
0.01	0°.0282	2.82	0°.0296	0°.0014
0.02	0 .0536	2.68	0 .0552	0 .0016
0.05	0 .1245	2.49	0 .1275	0 .0030
0.10	0 .2358	2.36	0 .240	0 .0040
0.20	0 .4498	2.25	0 .458	0 .0082

It is to be remarked, further, that the degree of dissociation is much smaller than in the case of any inorganic compound so far examined, being only 56% in the solution m = 0.01. (Kohlrausch's value for $\mu\infty$ (110) is assumed.)

4. Passing now to the $K H_2 PO_4$ where we have one H atom replaced by K, we find that the depressions produced belong to the group, KCl, NaCl, etc., and it at once suggests itself that with this salt, as with all members of the group, the molecule splits into two parts, in this case K, and $H_2 PO_4$, and that the degree of dissociation is about the same as for the other potassium salts of the group. Unfortunately no measurements on the conductivity of KH_2PO_4 in extreme dilution have been made so far as is known to the writer.

5. The replacement of a second atom of hydrogen by a metallic atom, as for example in the case of the two phosphates, Na_2HPO_4 and $Na(NH_4)HPO_4$ at once brings us into the second group, i. e. into the group of electrolytes which contain bivalent radicals, as $K_2 SO_4$, $Ba Cl_2$, etc. In this group the dissociation of the molecule is thought to be into three parts, and the degree of this dissociation on the average is about 80% in the solutions m = 0.01. *Assuming* the dissociation to be into three parts, namely, Na—Na—HPO_4, we are able to compute from the present data the degree of dissociation by the formula

$$\frac{\Delta}{m} = 1.89(1 + 2\delta)$$

in which δ is the degree of dissociation.

In this particular case, $Na_2 HPO_4$, the value of δ is given in the equation,

$$\frac{0.°0499}{0.01} = 1.89(1 + 2\delta) \quad \text{or}$$

$$\delta = 0.82.$$

For $Na_2 HPO_4$ the degree of dissociation in the solution m = 0.01 is thus, 82%. Values for the electrical conductivity of this salt in solution are not yet known.

6. Replacing now the third H atom with Na we have Na_3PO_4 and the observed depression for the solution m = 0.01 becomes 0.°0715C. To account for this very great depression the dissociation theory requires that the salt be dissociated 93%, each dissociated molecule yielding 4 parts. Here, however, as in the other cases, no observations on the electrical conductivity have as yet been made.

7. For the sake of inquiring as closely as possible into the interesting matter presented by these phosphates, observations were made on the freezing points of various mixtures of Na_2HPO_4 and NaOH solutions. The results are given at the end of the following table. The results for H_3PO_4 and the other phosphates under discussion are also found in the same table. The coefficients in column (1) indicate the number of $\frac{1}{100}$ gram-molecules of the respective constituents in the solution.

1	2 Δ	3 Successive Differences
1 H_3PO_4	0°.0282	
1 KH_2PO_4	0 .0358	0.0076
1 Na_2HPO_4	0 .0499	0.0141
1 Na_3PO_4	0 .0715	0.0216
1 Na_2HPO_4 + 1 NaOH	0 .0706	. . . . .
1 Na_2HPO_4 + 2 NaOH	0 .0995	0.0289
1 Na_2HPO_4 + 3 NaOH	0 .1279	0.0284

The successive differences which the series presents is not without interest. Assuming that in place of the salt KH_2PO_4 we had NaH_2PO_4 and that the depression due to the sodium salt would be sensibly the same as that of the potassium salt,* we observe that the addition of the first atom of Na increases the depression by 0°.0076, the second, 0°.0141, the third, 0°.0216. We have now reached the compound Na_3PO_4, to which 1 Na_2HPO_4+1 NaOH is seen to be equivalent, at least, within the limits of accuracy of the latter solution.

The further addition of 1 NaOH as in 1 Na_2HPO_4 + 2NaOH, which may be looked upon as equivalent to 1Na_3PO_4 + 1NaOH, increases the depression by 0.°0289. Thus far the successive differences appear, on the average, to be successive multiples of 0°.0073. The further addition of 1 NaOH, as appears in 1 Na_2HPO_4 + 3 NaOH, which is equivalent to 1Na_3PO_4 + 2 NaOH, is attended by about the same increase as that caused by the addition of the preceding molecule of NaOH, i. e. 0°.0284. It seems evident that the relation of the sodium atom to the rest of the molecules in the series of compounds examined, is less and less close as the number of sodium atoms increases, and this may be sufficient ground on which to account for the progressive alkaline properties of these salts.

I regret that these relations did not present themselves until the work was in preparation for publication (May–June), and thus no further observations could be made. I wish to emphasize that the results for Na_3PO_4 are probably affected with very large errors, perhaps amounting to 7% due to unavoidable inaccuracy in the preparation of the solutions. I have no means of judging, even, in which direction the error lies. My only apology for presenting the results is the fact that even so large an error as this, either + or —, would not affect essentially the nature of the interesting relations which the study of the phosphates has presented. The examination of this question from the standpoint of electrical conductivity is very desirable since it appears the dissociation theory would here encounter some decisive tests.

*My attempts to prepare solutions of NaH_2PO_4 which could be found by analysis to be accurate have thus far failed. All analogy, however, seems to allow the assumption which is made above.

The Organic Acids.

Acetic, Oxalic, Succinic, Tartaric and Citric.

The results are given below in tabular form.

In computing the theoretical values for the depressions, the Kohlrausch values for electrical conductivity were used in the case of Acetic acid. In other cases the Ostwald measurements were used.†

In all cases Ostwald's value for μ_∞ was assumed as the most probable. The value is given at the top of the separate tables. No electrical measurements, so far as is known to me, have been made on Citric acid. It should be said perhaps that the particular acids examined here, were chosen for the reason that they are to be had in a high state of purity and are easily made into solutions of exact molecular strength.

† Ostwald, Zeit. Phys. Chem., 111, pp. 281, 272, and 371.

1 m	2 $\frac{\Delta}{m}$	3 $\frac{\Delta}{m}$	4 $\Delta_{th}-\Delta_{ex}$
Acetic Acid, $C_2H_4O_2$. $\mu_\infty=364$			
0.01	0°.0196	1.96	±0.0
0.02	0 .0375	1.88	+0.0013
0.03	0 .0559	1.86	0.0020
0.05	0 .0928	1.86	0.0032
0.10	0 .1855	1.86	0.0055
0.20	0 .3732	1.87	0.0090
0.30	0 .5629	1.88	. . .
0.50	0 .9378	1.88	. . .
1.00	1 .886	1.89	0.01
Oxalic, $(COOH)_2$. $\mu_\infty=364$ (?)			
0.01	0°.0328	3.28	+0°.0023
0.02	0 .0640	3.20	0 .0036
0.05	0 .1519	3.04	
0.10	0 .2848	2.85	
0.20	0 .5329	2.66	
Succinic, $C_4H_6O_4$. $\mu_\infty=356$			
0.0100	0°.0202	2.02	+0°.0002
0.0199	0 .0391	1.96	0 .0007
0.0498	0 .0965	1.94	0 .0011
0.0995	0 .1876	1.89	
0.1990	0 .3751	1.89	
Tartaric, $C_4H_6O_6$. $\mu_\infty=356$			
0.0100	0°.0234	2.34	+0°.0005
0.0200	0 .0435	2.18	0 .0019
0.0499	0 .1042	2.09	0 .0028
0.0997	0 .2018	2.02	
0.1994	0 .3993	2.00	
Citric, $C_6H_8O_7$			
0.0100	0°.0226	2.26	No Data.
0.0200	0 .0424	2.12	
0.0499	0 .1029	2.06	
0.0998	0 .1999	2.00	
0.1997	0 .3978	1.99	

Discussion of Results.

This series of organic acids is chiefly interesting on account of the relation which is presented by them between the observed depressions and those required by the dissociation theory.

It appears that in the case of *Acetic*, *Succinic* and *Tartaric acids*, the agreement between the observed and theoretical values, for extreme dilution, is so nearly exact that, barring experimental errors, it may be regarded as complete. Further, these theoretical values of the depressions indicate that the Ostwald values for μ_∞ are very probable, although in the case of Acetic acid the experimental values for the electrical conductivity as found by Kohlrausch would not perhaps warrant the assumption of so high a value.

The exception presented by Oxalic acid is not to be overlooked. The acid presents difficulties in other directions as well as in the present instance and it may happen that a fuller knowledge of the nature of its aqueous solutions may lead to a reconciliation of the theoretical values of the depressions with the observed results.

Methyl alcohol, $(CH_3)HO$, *Glycerine*, $C_3H_5(HO_3)$, *and Glucose*, $C_6H_{12}O_6$.

The results are given in following table:

1 m	2 Δ	3 $\frac{\Delta}{m}$
$(CH_3)HO$.		
0.0103	0°.0183	1.78
0.0205	0 .0362	1.77
0.0308	0 .0548	1.78
0.0514	0 .0910	1.77
0.1027	0 .1818	1.77
0.2054	0 .3655	1.78
$C_3H_5(HO)_3$.		
0.0098	0°.0186	1.90
0.0197	0 .0372	1.89
0.0492	0 .0929	1.89
0.0984	0 .1869	1.90
0.1968	0 .3758	1.91
$C_6H_{12}O_6$.		
0.0099	0°.0185	1.88
0.0197	0 .0363	1.84
0.0493	0 .0916	1.86
0.0986	0 .1850	1.88
0.1971	0 .3745	1.90

These three compounds are of the class known as non-electrolytes, and are thus incapable of dissociation. Accordingly the molecular depression produced by them should be independent of the concentra-

tion of the solution, and for all such compounds the molecular depression should have the value of the van't Hoff constant (1.89). The present results only approximately sustain these theoretical deductions. For while the values for methyl alcohol are practically *constant* they are uniformly less than 1.89, and in the remaining two cases the values exhibit an unmistakable *increase* of molecular depression with increase of concentration, which, allowing experimental errors of 0°.0003 C, is strictly uniform throughout the entire region.

The fact that their value is 1.89 in the region of mean concentration can have, I think, no theoretical bearing. This increase in the molecular depression here exhibited accords with the results already found by the author for Cane Sugar, Urea and Ethyl Alcohol* where it appears that the molecular depression for these compounds also increases with the concentration. The increase then observed became uniform at about $m = 0.05$. I believe, however, that the more rapid increase in the molecular depression in the region $m = 0.01$ to $m = 0.05$, than in the region beyond $m = 0.05$, which the earlier observations exhibited, was due to an experimental error, the existence of which has only recently been made known to me and which will be fully discussed at a later time. The extension of the present theories of solution, in order to explain this uniform increase, will be very easy. For the present, however, the great need is more experimental facts.

Summary of Results.

1. The observations on the four chlorides of the present series together with the additional ones on the five chlorides previously studied establish the fact that the *molecular depression of the freezing point for all the chlorides reaches a minimum value.*

This minimum is very pronounced for all the binary chlorides. $SuCl_4$ yields such enormous depressions that the measurements could not be carried far enough to establish any conclusion in this regard. There is however no doubt that this salt will exhibit the same minimum when the observations are sufficiently extended in the region of greater concentration.

2. Tin chloride, in the solution $m = 0.01$, produces a molecular depression of 12.61. This is more than five times the value of the van't Hoff constant (1.89.) The hypothesis of Arrhenius thus fails to explain the depression, since the greatest possible number of "active molecules" which a molecule of $SuCl_4$ could yield would be 5, and thus the maximum molecular depression which it could produce would be 5×1.89 or 9 45. The observed value is 12.61 at $m = 0.01$.

It may be suggested, however, that $SuCl_4$ in solution possesses the properties of a mixture of $SuCl_2$ and 2 HCl. In this case the molecular depression would be very nearly the sum of the molecular depressions due to each or $5.20 + 2 \times 3.62 = 12.44$. This is not far from the observed value. The strong acid reaction of $SuCl_4$ in solution favors this assumption.

3. The study of the phosphates makes it probable that H_3PO_4 in aqueous solution is dissociated into two parts, namely, H and H_2PO_4. This appears from the fact that its salt KH_2PO_4 gives a depression which belongs to the group of electrolytes which yield two parts in the process of dissociation (NaCl, KCl, etc.) *The salt yields K, and H_2PO_4, and this points to the conclusion that the acid behaves similarly.*

Further it appears that the successive introduction of a univalent metallic radical into a salt of phosphoric acid increases the depression by a constant amount for each radical so added. This may be explained in the language of the dissociation theory by saying that the introduction of each metallic radical increases by one the number of parts into which the molecule is

*Wiedemann's Ann., 1894, 51, p. 500.

dissociated and causes no change in the "*degree*" of the dissociation.

Thus in KH_2PO_4 there are two parts, $K-H_2PO_4$,

in Na_2HPO_4 there are three parts, $Na-Na-$ and HPO_4,

in Na_3PO_4 there are four parts, $Na-Na-Na-PO_4$.

This may account for the progressive alkaline properties of this series of salts.

4. Sodium silicate, Na_2SiO_3 presents the same difficulty as $SuCl_4$, *i. e.*, the depression is much greater than the simple hypothesis of Arrhenius is able to account for.

5. The organic acids,—acetic, oxalic, succinic, tartaric and citric,—exhibit the characteristics of the electrolytes, and not those of the non-electrolytes. The only exception is acetic acid in the region of greater concentration, where the molecular depression *increases uniformly with the concentration*, as is the case with the non-electrolytes.

6. A comparison of the experimental results with those required by the hypothesis of van't Hoff and Arrhenius shows an agreement in the case of LiCl and $CaCl_2$, which is practically complete. A most striking agreement is also seen in the organic acids,—acetic, succinic and tartaric. A fair agreement is found also in the case of $SrCl_2$.

On the contrary, HNO_3, HOH and NaOH deviate very widely from the "theory." The differences amount to 8—11% for the most dilute solution of these salts. The fact that these differences become gradually smaller as the concentration of the solution is increased, and that they almost vanish in the solutions of greatest concentration seems to point to some unknown source of experimental error peculiar to the solutions.

In the remaining cases—$SnCl_4$ citric acid and the salts of phosphoric acid—no measurements of the electrical resistances have been made, and thus no data are at hand for computing the theoretical values of the depressions.

These measurements are much needed, as well as those for $MgCl_2$ and NH_4Cl in extreme dilution.

The results of the observation on the non-electrolytes require no further mention.

SUMMARIES OF PAPERS PUBLISHED.

A STUDY OF MRS. BROWNING.

BY T. W. HUNT.

Professor Hunt, in this critique, after giving a brief account of the life and writings of Mrs. Browning, discusses at some length the characteristics of her poetry. Emphasis is laid upon the scholarly quality of her verse; upon her poetic imagination, sensibility, and taste, as, also, upon the practical and beneficent ends which, as a poetess, she always had in view.

By way of adverse criticism, attention is called to Mrs. Browning's alleged narrowness of intellectual range, and her tendency to the morbid and unduly subjective method. These limitations conceded, however, the critic insists that Mrs. Browning filled the place and did the work assigned her and reached the farthest limit yet attained by any British poetess.

[Presbyterian and Reformed Review, July, 1896.]

THE STUDY OF ENGLISH IN AMERICAN COLLEGES.

BY T. W. HUNT.

This paper opens with a reference to the widely increasing interest that the study of English is now eliciting in the schools and colleges of the country. The specific elements of promise now visible in English study are said to be—a closer interaction of collegiate and secondary English, and

higher ideals and better methods in teaching. The most pressing needs in the department at present are discussed,—such as the enlargement of English courses, the multiplication of efficient teachers, and most especially, the increase of library facilities. In the course of the article, Professor Hunt calls attention to some questions of interest still unsettled, such as: the best methods of teaching English Philology and Literature, the limits of specialization in English, and the proper place of English study in our schools of Science. The paper closes with a strong endorsement of classical studies as essential to English scholars, and emphasizes the fact that the cultivation of a pronounced literary taste and spirit is, after all, the most desirable outcome of all educational English work.

[Educational Review, Sept., 1896.]

OBSERVATIONS ON ANTIDROMY.

By GEORGE MACLOSKIE.

Last year I adduced evidence to show that there are two castes of every flowering plant, differing somewhat as one's right and left hand differ; and that this difference is observable in the arrangement of the leaves, of the flowers, of the seed vessels, and in the internal structure of the stems; especially that it can be detected in the embryos, or young plants in the seeds. This primitive tendency was traced to the origin of the young plant on the right or left margin of the fruit-leaf or carpel. A solitary observation then made turns out to represent a large class of cases, proving that forking rootstalks produce antidromic plants on the two branches of the fork, which can be seen in calla-lily, may-apple, water-lily, Helonias, and many other plants. Tussocks of sedge, though derived by budding from a common stalk, consist of two kinds of plants.

In last spring I found a large number of new and interesting cases coming under the general rule. As a bed of lily-of-the-valley consists of two sorts of plants, with the inner leaf of each plant folded in some towards your right and in others towards your left, and having the flowers arranged in right-handed and left-handed spirals; so dog-tooth violet and spring-beauty exhibit similar right-and-left diversity. But very often secondary distortions and opposition of leaves or their spreading out under sunshine, hide the evidence. In many of these cases, however, a closer scrutiny shows that there is real antidromy, though reduced to a mere trace.

During last summer I made observations on the subject in the large gardens and museums of Europe. The Palms generally, and Screw Pines, species of cactus (*Mammillaria*), *Tamarix*, and many other plants, presented themselves as interesting illustrations of the law. Dr. Urban, of Berlin Botanische Museum, directed my attention to his papers on the twisted fruits of *Medicago*, and of *Blumenbachia;* and I found that whilst in *Blumenbachia* all the fruits are twisted in one direction, there are peculiarities of the leaves which show a two-fold phyllotoxy; thus the monodromic caste of the fruit is superposed upon an antidromic diversity as to the vegetation. I find a similar character to be true as to Horse-chestnuts and as to Catalpa; the stems of these, especially of old trees, always undergo a dextrorse torsion, but the seeds are of two kinds, those of a horse-chestnut tree, having some of them the tip of the radicle turning towards your right whilst in others it turns to your left; in Catalpa a dark spot on the surface of the seed runs in different directions in the different seeds; also the

allied plant, *Jacaranda*, notwithstanding its opposite leaves, exhibits spiral orthostiches in contrary directions, so as to prove its antidromic character.

Two important additions were made to the evidence, one concerning the gymnosperms (Pines and their allies), and the other concerning the Ferns and great coal-plants. The scars of the leaves of the Pines and Cycads, and the spiral rows of the cones conclusively prove that they are antidromic. As to the Ferns and other acrogenous plants the case is equally clear. We have in Princeton Museum a piece of Fernstem so bilaterally symmetrical as to its leaf-scars as to raise a difficulty. But living tree ferns in Kensington Gardens and in Jardin des Plantes, showed that whilst the basal part of the stem is antidromic the upper part may lose this character so as to show perfect bilateral symmetry. In the Natural History Museum at South Kensington, London, I found that such fossil plants as *Lepidodendron* and *Sigillaria* were antidromic. Thus the general law appears to include all the Phanerogams, with the Gymnosperms and the Pteridophyta. The cases of tree-ferns and horse-chestnut may help us to understand how, as in some species of *Sigillaria*, the primitive caste may partially disappear, or be even subsequently replaced by a constant secondary twist.

I beg to express my thanks for courtesies to the officers of Kew Gardens, near London, and of the Jardin des Plantes, Paris, to Mr. F. A. Bather of the Natural History Museum, London, to Herr Otto Müller of the Botanische Garten of the University of Strassburg, and to Dr. Ign. Urban of the Museum der Koenige Botan. Garten of Berlin.

[Summary of a paper contributed to the Torrey Bulletin, September 29, '96.]

THE RELATION OF FAITH AND CERTAINTY.

By JACOB POPPEN.

Man thirsts for knowledge, which is "the reflection in our consciousness of whatever exists." In the acquisition of knowledge the mind obtains convictions, and the question of their genuineness is a vital one. Certainty is desired. "Certainty is sure conviction of mind." Whatever is, objectively, is certain, but not for us till the conviction of it enters our mind. On the other hand, there may be conviction of what is not really true. A conviction, then, to be certain must be objectively in accordance with reality, and subjectively free from doubt. This dissertation concerns itself with the question of knowledge, and more especially seeks to show what part faith plays in the establishment of certainty. The author now determines the meaning of faith as he uses the term. It is not used in any restricted sense, such as the content of a creed. Neither is any inquiry intended as to the quantity of knowledge given by faith as distinguished from that given in other ways. It is the function of faith in all knowledge that is sought. In this sense faith is a function of the intellect. "It is that function of the psyche whereby man receives direct certainty without the intervention of discursive thinking or argument." It is to be contrasted with sense perception and argumentation, not with knowledge. The author seeks to justify this meaning of faith both from its etymology and its usage. Having determined the meaning of faith, in the consideration of its relation to knowledge, the question comes up—how is knowledge obtained? The organ of knowledge is consciousness, but this is not its subject. Knowledge presupposes the existence of the knowing subject and its identity. These are given by faith. Other views on this point are briefly criti-

cized by the author. Further, faith forms the "bridge" between the ego and the non-ego. The reality of the external world cannot be proven, and must be given by faith. Here also the author gives a brief criticism of other theories. Again, the knowledge of the external world includes the sphere of the natural sciences which rest on faith; first, as to the reality of the phenomena with which they deal; second, in that they have to do with relations of these phenomena not accessible to perception but depending on the reasoning function which has certain presuppositions which must be accepted by faith; and third, in the use of induction and the establishment of general laws, the "universality" and "necessity" of such laws is a matter of faith. The author continues the discussion in the sphere of history and social science, seeking to show the importance of the faith element, and then takes up philosophy for the same purpose. Philosophy deals with the non-sensuous, and all systems must start with certain faith data. The differences in systems are largely differences in the data or premises. Positivism, Scepticism, and Idealism are taken as illustrations. The effect of moral evil in obscuring knowledge is also taken up. It is least in the natural sciences, increasing till it reaches its maximum in those sciences which deal with man. The author holds to the theological doctrine of "palingenesis" as counteracting this. To attain truth man must be born again. The last part of the dissertation is taken up with a discussion of the question as to the means of obtaining a norm by which to determine the content of this faith. Universality, common sense, and genius are rejected, and epistemology is rested on a theistic basis, and also on the aforementioned idea of "palingenesis." The dissertation concludes by trying to show that the deliverances of this faith are supported in many cases by demonstrative proof which, however, is less and less possible as we advance in the scale of the sciences, the ultimate problems of philosophy and religion being not only beyond the sphere of demonstration, but of all knowledge, resting entirely on faith.

[Abstract of Dissertation presented to the Faculty of Princeton College for the Degree of Doctor of Philosophy, February, 1896.]

THE LEGISLATION OF CONGRESS FOR THE GOVERNMENT OF THE ORGANIZED TERRITORIES OF THE UNITED STATES.

By MAX FARRAND.

The object of the paper is to show that "Congress, since 1789, has carried on the work" (of territorial government) "in the spirit and with the purposes of the Ordinance of 1787, and has simply expanded this frame-work of territorial government on the same lines that the whole country has developed."

The author first discusses the "origin of the Public Territory of the United States" under which caption he recites, in detail, the struggle between the greater and the smaller States, resulting in the cession of the great northwest territory to the Confederation.

Having gained possession of this vast territory it became necessary to provide for governing it and for connecting it, in some way, with the Confederation. Accordingly Congress appointed a committee, of which Thomas Jefferson was chairman, to submit a plan for accomplishing this; and on March 1, 1784, they reported the ordinance, now known as Jefferson's ordinance, which with some important modifications was adopted. But so many well founded objections were made to this ordinance, that "Congress proceeded to legislate anew on the whole subject." A number of plans were reported but "finally on July 13, 1787, the now famous ordinance of 1787 was adopted."

As this ordinance undertook to make political organizations, to provide for the admission of new States into the Confederacy and to deal directly with the rights of individuals, it was quite different from any instrument that had before been considered by Congress.

It left the northwest territory undivided, yet subject to division by Congress; regulated the descent and distribution of estates and was, in fact, the "first general legislation" by Congress upon the subject of real property.

It also outlined the plan for the organization of the government and specified the powers and duties of the chief officials. It provided for the establishment of local self-government and a full representation in Congress as soon as the population should reach a prescribed limit. It laid down the qualification necessary for a representative, one of which was the ownership of 200 acres of land within the territory.

It contained a compact of everlasting allegiance to the Confederation, and guaranteed religious toleration, the "benefits of the writ of habeas corpus, trial by jury, proportionate representation in the Legislature," bail, moderate fines and punishments and the preservation of liberty and property.

It provided also for the formation of not less than three nor more than five States in the territory and roughly indicated their boundaries; and closed with the prohibition of slavery.

The provisions of these two acts were known to be extra legal, but the conditions of the cession of the land had made such steps necessary, and in those conditions all the States had acquiesced. Thus the moral right to legislate thus beyond the powers given by the articles of confederation was unquestionable; but the legal right was not so evident. Accordingly Madison proposed the plan which now stands in the third section of the fourth article of the Federal Constitution; and upon this as a basis the First Congress, in 1789, re-enacted the ordinance of 1787, with such changes as the new Constitution made necessary.

By the authority thus given the United States has organized and governed, in all, twenty-eight territories; and the object of the author from this point is to show that all legislation upon the subject of governing these various territories is but a further development of the principles of the Ordinance of 1787, as re-enacted by the First Congress of 1789.

At this point he distinguishes two periods, of which the first extends down to 1836, the date of the passage of the organic act for the territory of Wisconsin. During this period, as he shows by tracing the legislation with regard to each territory organized within this period, the Ordinance of 1787 served as a model.

By a careful and detailed examination of the four great divisions of this period, *i. e.*

1. Legislation concerning territory east of the Mississippi.

2. Legislation concerning territory west of the Mississippi.

3. Until the organization of the territory of Florida.

4. From the organization of Florida to the end of the first period, he shows that the following changes in the form of Territorial Government under the Ordinance have become established:

1. Congress has a right to divide any Territory or change its boundaries as it chooses.

2. The Governor cannot prorogue the Legislature.

3. The Governor may grant pardons for offenses against the territory and reprieves for those against the United States, until the decision of the President be made known.

4. The Legislature and

5. The Delegate to Congress shall be elected by the people.

6. All local officers are to be elected by the people or they are left to the Legislature to determine.

7. Property qualifications for the exercise of suffrage have been abolished.

8. Every voter is eligible to every office.

9. Expenses of the Legislature are paid by the United States.

10. The sessions of the Legislature are limited in length and frequency.

11. The members of the Legislature shall not be eligible during their term or for one year thereafter to any office which has been created during that term.

12. There shall be an organized judiciary, consisting of a superior court, district courts, and other inferior courts.

13. The superior court must be held by a quorum of the superior judges, while each of the district courts may be held by one of the superior judges.

14. The Legislature may be authorized to fix the jurisdiction of all the courts, with certain specified provisions.

15. An attorney and a marshal for the United States are appointed in every Territory.

16. The Legislature is authorized to locate the seat of government of the Territory.

At the close of this period there were only three territories under the United States, Arkansas, Michigan and Florida, and the tendency is very manifest to establish a uniform system over them and to use only such provisions as had already proved successful.

The Ordinance of 1787 was simple and general in its provisions, and Congress had found it necessary to specify more and more minutely how the Territories should be governed. Thus the additions made, during this period, to the great principles of the Ordinance were very few; but a multitude of details were added and great changes were made in the forms, etc., of government, such as methods of election, qualifications for voting and holding office, organization and powers of the judiciary, etc.

The first was a period of experiment; but when we reach the second period, the time when congress was called upon to organize the Territory of Wisconsin, there was no longer any question. Its government was based upon the Ordinance of 1787 also; but it was that Ordinance remodeled in the light of the experience of the first period; and so thoroughly was the work done that the organic acts of the sixteen territories that have since been established are but copies of the Wisconsin act of 1836. A few changes have since been made, but they are so slight as to be of comparatively little importance.

From this point it is but a step to the point of enacting laws which are to affect the territories as a whole; and this is the characteristic feature of the later legislation of Congress. But before Congress could proceed to this form of legislation, the question had to be finally settled as to the extent of authority it could exercise over the territories. As a result of the civil war the absolute control of the territories by Congress was established, so that the second period falls into two divisions:

1. Extending from the Wisconsin act of 1836 until the establishment of the principle of "absolute control" in 1867.

2. Extending from 1867 to the present.

Here the author gives a brief account of the Wisconsin act of 1836, by which all that remained of the great northwest territory was organized. It was modeled, not directly upon the Ordinance of 1787, as all previous acts had been, but upon the act of Orleans of 1804, which stands as the first departure from the Ordinance of 1787.

In 1836 Iowa was formed from the western part of the Wisconsin Territory

and its act was an exact copy of the Wisconsin act except as regards the length of the terms of officers.

Then for a period of ten years no territory was organized, and the territorial legislation relates chiefly to the Legislatures.

From 1848 to 1864 thirteen new territories were organized and all of the governments established were closely modeled after the Wisconsin act, except in a few details and with reference to slavery. And the same is shown to be true for Washington, (1853); New Mexico and Utah, (1850); Kansas and Nebraska, (1854); and Colorado, Nevada and Dakota (1861).

In 1862 all slavery was prohibited in all Territories of the United States, and this first division of the second period closes with a statute passed in 1867, ordering "that there shall be no denial of the elective franchise in any of the territories of the United States, now or hereafter to be organized, to any citizen thereof, on account of race, color or previous condition of servitude."

These two laws introduce us very naturally to the last division of the topic, of which the chief characteristic is general legislation or legislation for the Territories as a whole.

Slavery destroyed the last dividing line between the Territories. The judicial systems of all the Territories had always been quite uniform on account of their common subordination to the Supreme Court of the United States. Uniform bankruptcy laws were soon established and gradually the point was reached at which laws could be passed affecting all of the Territories at once.

The author takes the Legislatures as an example and shows how uniformity in this department was gradually attained so that one law could be made to apply to all.

The last Territories to be organized were Wyoming (1868) and Oklahoma (1890), but their organic acts contain nothing new.

To-day there are only three organized territories under the United States, New Mexico, Arizona and Oklahoma, and their governments are practically identical. The author closes with a discussion of these governments, and shows that their general principles are the same as those laid down in the Ordinance of 1787; but that the details are vastly different. The chief differences which he points out are:

1. The machinery of the present Territorial government is vastly more perfect.
2. It is vastly more Democratic.
3. The salaries paid to officials are much larger.
4. They are more completely subject to Congress.

[Abstract of Thesis presented to the Faculty of Princeton College for the Degree of Doctor of Philosophy, June, 1896.]

THE ANATOMY AND PHYLOGENY OF AMPHIUMA MEANS.

By ALVIN DAVISON.

Amphiuma means is of special interest to biologists because of its degenerate structure. Our knowledge of its embryonic life is limited to the observations of Hay and Kingsley on a single batch of imperfectly preserved embryos. This urodel refuses to breed in captivity, and in its natural habitat the eggs are so securely concealed that they have been discovered in only one or two instances. No one had secured a young specimen less than six inches in length prior to February, 1894, when the writer obtained from North Carolina several specimens from seventy-eight millimeters to ninety millimeters in length. A comparison of these with the adult serves to settle some disputed points in anatomy as well as add to our sparse phylogenetic data.

Hay and Wiedersheim disagree as to the manner in which the olfactory nerve pierces the frontal bone, the former maintaining that there is present only an unmodified aperture for the exit of the nerve while the latter affirms that a bony canal is present through which the nerve runs. The facts in the case are that Hay's description is correct for the young and Wiedersheim's is correct for the adult. The anatomy of the young was demonstrated by microscopical examination of stained serial sections of the head in three planes.

The unpaired piece of cartilage in the roof of the mouth of the adult between the anterior ends of the vomero-palatines was not present in Hay's embryos but he explained the presence of this cartilage in the adult by conjecturing that it was cut off from that forming the floor of the nasal sacs by the ossification of the roof-bones of the mouth. The writer's observations prove this conjecture incorrect, since the roof-bones of the mouth are fully ossified before the unpaired cartilage is formed. In a specimen eighty-eight millimeters long, the cells of the dense connective tissue are concentrically arranged preparatory to the formation of true cartilage, which, in a specimen ninety millimeters long, has made its appearance. Observations on the adult show that the teeth of the mandible do not coincide with the teeth of the premaxillo-maxillary series, but bite within them, the anterior mandibular teeth thereby stimulating the above described growth of cartilage in the same manner as the horns originated in the *Cavicornia* and *Cervidae*. A similar abbreviation of the lower jaw is exhibited by the majority of Gymnophiona as shown by Wiedersheim.

The axial skeleton and appendages in the young present the following interesting conditions: The vertebrae are only partially ossified. The transverse processes are wholly cartilaginous, and a portion of the internal part of the body of the vertebrae is unossified. The cartilaginous dorsal projection of the roof of the spinal cord is invested with a thin parostosis. The short ribs projecting from the anterior part of the vertebral column are present as cartilage. The shoulder girdle is entirely cartilaginous, the scapula being only two cells in thickness. No sternum is present. The humerus is covered with a thin layer of bone, except in the regions of the extremities. The radius and ulna are also ossifying externally. The carpal elements are present as pure cartilage and the phalanges show no evidence of ossification. The pelvic girdle is entirely cartilaginous. All the elements are present as in the adults, but there is no evidence of the posterior bony disc. The femur is invested with a very delicate ectostosis in the shaft region. The future prominent trochanter process is indicated by a slight flexion of the cartilage at that point. The two abductor, the adductor and two rotator muscles have the same locations as in the adult. The tibia, fibula, tarsus, metatarsus and phalanges show no signs of ossification. This affords weighty evidence that the formation of the anterior limbs is in advance of the posterior. This condition favors the assumption that this amphibian is degenerating toward a legless form and will lose its posterior limbs first.

The arrangement of the muscular elements in the trunk region of the adult is peculiar. In the superior dorsal mass there are three rows of cones lying side by side. The apices of the row adjacent to the axis are directed posteriorly, those of second ectad row anteriorly and those of the third ectad row posteriorly. Each cone is introduced into the preceding one about one one-third of its length. In the middle row the deep sides of the bases

are attached to the post-zygapophyses and their spines. The distal and proximal sides of the bases are continued as the lateral boundaries of cones in the adjacent rows. The deep side of the base of each cone is inserted on the postero-lateral division of the neural spine. The proximal side of the base of the cones in the row adjacent to the neural axis is fastened to the neural spine. Since the arrangement of the cones is so regular it is easy to estimate their number, which is three hundred and seventy-two in the superior dorsal mass. Since the inferior dorsal mass and the tail-muscles have also a conical arrangement it is seen that the dorsal and caudal muscles of *Amphiuma* have over one thousand strong fascial attachments. This complete conical disposition of the fibres of the dorsal muscles has been observed in only two other vertebrates. Dr. Hair has described them in the alligator and the writer has noticed the same structure prevalent in *Sphaenodon*, the peculiar New Zealand lizard.

The ventral trunk muscles are composed of four sheets of fibres: the transversalis abdominalis, the obliquus internus, obliquus externus, and rectus abdominalis. The first is a mere continuation of the descending lamina of the external dorsal fascia. It may therefore be said to arise from the neural spines, and with its fellow forms a tube inclosing the viscera and dorsal muscles. In other words the lamina may be considered as an aponeurosis, the muscle-fibres originating just before the aponeurosis emerges into the body cavity. The muscle passes transversely around the ventrum, dwindling again to fascia about one centimetre before joining its fellow along the midline. The striking feature in this muscle is that it is unaffected by the inscriptiones tendineae, a condition not present in any other *amphibian*. The obliquus internus and externus are thicker on the left side than on the right. The left dorsal mass is also stronger than the right. This asymmetry is probably due to the manner in which the animal lies coiled in the colder season of the year. Both the trunk and head muscles of *amphiuma* are more highly specialized than those of other Urodels, while the limb muscles are less specialized. The late embryonic development of the numerous processes on the trunk vertebrae indicates that the complexity of the trunk muscles was developed as the use of the limbs diminished.

The most important phylogenetic feature discovered by the writer is the presence of what is probably an atrophied tentacular apparatus. In the smallest specimen, seventy-eight millimeters in length, a canal less than a millimeter long exists in the suborbital region beneath the skin and underlying fascia. The canal is lined by columnar epithelial cells, in many of which the nuclei are distinctly seen, whereas in others it is wanting and the cell wall has degenerated. External to the epithelial wall is seen a thick layer of apparently degenerated glandular tissue, which is bounded by a thin layer of fibrous connective tissue. This structure was detected on the right hand side only of one specimen. A careful search in other specimens slightly larger failed to reveal any evidence of the degenerate organ. Wiedersheim, in Die Anatomie der Gymnophionen, has described a functional tentacular apparatus composed of a columnar-epithelial-walled canal, a retractor muscle lying in the glandular tissue beneath the canal and a sheath of fibrous connective tissue surrounding the gland, muscle and canal for the tentacle. These parts are disposed in the same manner as in *Amphiuma*. In a few *Amphiuma* sections even the remnants of the retractor muscle were visible. In the suborbital region of *Gymno-*

phiona three branches of the maxillary nerve attend the tentacular apparatus. In *Amphiuma* these three branches of the maxillary nerve are present, occupying the same position relative to the tentacular apparatus.

Cope derives the *Caeciliidae* from the *Amphiumidae*. The presence of an ethmoid bone in the former and its absence in the latter is unfavorable to Cope's phylogeny. The elongated cranium, the double series of teeth, the tentacular apparatus, the degenerated optic sense, the manner of fructification and incubation of the eggs, the habits of the young, the degenerate limbs, the unusual disposition of the transversalis abdominalis, the inequality in the length of the lungs, the anterior hypapophyses, and the amphicoelous vetebrae, all of which the *Amphiumidae* and *Caeciliidae* possess in common, point to a common parent form. Wiedersheim believes that the origin of the *Caeciliidae* is to be sought in the stegocephalans of the carboniferous. It therefore seems probable that the Amphiumidae originated far back in geologic time.

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THE SPECIFIC HEATS OF THE METALS.

By F. A. WATERMAN.

A review of the work which has been done in determinations of the specific heats of the metals, renders evident the difficulty of obtaining a satisfactory series of results. A classification of the sources of error in such work leads us to a consideration of the following:

First. The purity of the metals used.

Obviously no method, however satisfactory in principle, or carefully undertaken, can give satisfactory results if such results are condemned from the beginning because of the nature of the metal used. Yet the majority of published results are obtained by use of somewhat impure materials. In some cases this was due to the opinion that a slight degree of impurity might be considered negligible, but in the greater number of cases it was due to the difficulty of obtaining metals as nearly absolutely pure as could be prepared. There is, therefore, much uncertainty as to the meaning of the terms "pure," "nearly pure," etc., as applied to metals used, as few investigators have presented chemical analyses. The development of chemical methods for the purification of metals has rendered it possible at the present time for investigators to secure materials much more nearly pure than those formerly available, and in this respect, at least, recent work should be given greater consideration than that of former investigatiors. In addition to this uncertainty as to the purity of the metals used attention should be called to the condition and previous treatment of the metals. We note determinations made upon metals powdered, in small fragments, crystalline, cast into small or large masses, drawn into rods or wires, or rolled into sheets. It is well known that molecular structural changes produced by mechanical operations produce a very perceptible change in the specific heat of a metal. Results obtained from metals which have been subjected to such diverse operations are, therefore, not properly comparable.

Second. The determination of temperature.

In this we have a source of error, common to all calorimetric methods, which is undoubtedly the cause of many of the discrepancies observed in the results obtained. All the difficulties involved in the exact use of mercurial thermometers are concerned in this. It would appear that undue reliance has been placed upon

the degree of accuracy obtainable by the correction of the readings of the thermometers which have generally been used. This holds true especially in the case of thermometers used for determining temperatures somewhat above or below room temperatures when a correction for stem exposure has been applied.

Third. The methods employed.

Of the many calorimetric methods that have been devised those most worthy of consideration are based upon the Heat Equivalent of Fusion of ice, the Heat Equivalent of Vaporization of water, and the change in temperature produced in a liquid by the immersion of a body of different temperature.

The first of these methods, commonly known as the Method of Melting Ice, has been best applied by use of the well-known form of Bunsen's Ice Calorimeter. It is unfortunate that this calorimeter, which appears theoretically so satisfactory, is found to be deficient in accuracy in operation. The sources of error, exclusive of errors of thermometry common to all methods, are chiefly those arising from the dependence of the results upon the calibration of the instrument by means of previous determinations of the specific gravity of ice, and those arising from uncertain "rate" of motion of the mercury in the capillary tube. As to the former, it is obvious that the differing results obtained by different investigators, ranging from .905 to .950, suggest doubt as to the accuracy of results based upon a quantity the value of which appears so uncertain. As to the latter, the effect of slight impurities in the snow or ice surrounding the calorimeter is to cause such a constant deposition of ice on the ice cylinder as to cause the mercury column to move many scale divisions in a minute. This motion, even under favorable conditions, is not exactly proportional to the time, and often occurs in a very irregular manner, thus rendering uncertain the confidence which may be placed in the indications of the mercury column when corrected for "rate" of motion. This calorimeter is also subject to error in failure to exclude absorbed air from the instrument when first filled with water. This can be done if the operation is conducted with great care, but it is doubtful whether operators have usually been successful in this respect. The fact that the above sources of error have rendered the results obtained by use of this calorimeter somewhat doubtful, is rendered evident by a review of the best results obtained. We note that the results obtained by different investigators are not concordant; that they do not agree well with results generally obtained by other methods, and that even the results obtained by the same person using the same material on different occasions are not concordant. At present it may be sufficient to cite the results obtained by Bunsen for calcium—.1722 and .1688—showing a difference of 2 per cent. in the values as determined by one presumably thoroughly conversant with the best methods of procedure with this calorimeter. It should, however, be borne in mind that this method was designed especially for the determination of the specific heats of the rare elements, of which but a small quantity may be obtained in a pure state, and for this purpose it has been most frequently applied.

Upon the heat equivalent of vaporization of water, has been based the method of condensation as applied in the Gravimetric calorimeter devised by Mr. J. Joly. The principle applied is simple. If a given mass of a substance at known temperature be plunged into steam, it experiences a rise in temperature and absorbs a number of calories of heat from the steam which is condensed upon its surface. The heat equivalent of vaporization of water at the given temperature being known, we have to determine the temper-

atures and the weights of the given body, before and after the condensation of steam upon its surface, to obtain the necessary data. The most important conditions of operation are thus: Sudden replacement of the air surrounding the substance by the vapor to be condensed; perfect mechanical conditions permitting the evaluation of the weight condensed, while the substance is still surrounded by the vapor. In practice, however, several corrections must be applied. The weight of steam condensed upon the bucket which holds the given substance must be determined from preliminary experiments for the given temperature range, and subtracted from the total weight of steam deposited. Correction to the weight of the body when immersed in steam must be made, owing to the different densities of steam and air. Exclusive of errors of thermometry, this method is, therefore, subject to the following sources of error: Errors arising from the application of the correction factors; loss of water condensed upon the bucket, which may drop from time to time; variations produced by deposition of water upon the suspension wire at the point at which it enters the steam chamber; a constant dependence upon the accuracy of the values previously determined for the heat equivalent of vaporization of water at the given temperature. It is evident, therefore, that, although results obtained by this method may agree quite closely among themselves, there may be constant errors in a series of observations which may render the results less worthy of confidence than the method might at first promise.

The third method, commonly known as the Method of Mixtures, was first successfully applied by Victor Regnault, and as described in his classic researches it deserves especial attention. This method, as applied by Regnault and his followers, together with its modifications, has yielded the best results thus far obtained in all cases in which a considerable mass of pure metal might be obtained. This fact is readily attested by a comparison of the great uniformity of the results obtained by different observers employing this method at various times as compared with results obtained by other methods. The facilities available for his work and his extraordinary ability in overcoming experimental difficulties render Regnault's work admirable in many respects. Without entering into details as to the familiar apparatus used and its operation, it is perhaps sufficient to say that probably the greatest source of error in the application of this method is found in the calculation of the radiation correction. For the purpose of avoiding this source of error I have devised a calorimeter, for which no radiation correction is needed.*

Results obtained.

Though subject to the errors which may arise in the application of the above three calorimetric methods the tabulated results which I have submitted give, I believe, the best determinations that have yet been made of the Specific Heats of the metals. They are suggestive as affording a basis of comparison of the best calorimetric methods, so far as such a comparison is possible while doubt exists as to the purity of the metals employed and the accuracy of the thermometry. I have excluded results obtained by the Method of Cooling, together with those obtained by various other methods which have been employed to a greater or less extent, but have been shown to be unreliable. No satisfactory determinations of the Specific Heats of the following metals could be found: Barium, Caesium, Chromium, Erbium, Rubidium, Scandium, Strontium, Tantalum, Terbium, Vanadium, Ytterbium and Yttrium.

*London, Edinburgh and Dublin Philosophical Magazine (5) Vol. 40, p. 413, 1895. Abstract in "Bulletin" Vol. 8, p. 13, 1896.

Of the results submitted the determinations which I have made of the Specific Heats of Bismuth .03035, and Tin .05453, are probably very nearly correct values for their means for the given temperature range. These metals were supplied to me by Mr. G. A. Hulett in a chemically pure state. The values found for aluminium .21946 and Copper .09471 are not quite as accurate, as these metals contained slight traces of impurities. The selection of the probable values of the mean Specific Heats of the metals between 0° and 100° C. from the tabulated results is difficult in view of the considerations which have been stated. In this selection greater weight has been given to results obtained by the Method of Mixtures than to those obtained by the Method of Condensation or the Method of Melting Ice. This preference is due partly to the sources of error which may exist in the latter methods and partly to the fact that, judging by results, those obtained by use of the Method of Mixtures seem to be best sustained. We may judge of the accuracy of the Method of Condensation by the work of Mr. Joly, but it has not been generally used and we are unable to determine what concordance there might be in the work of various investigators employing this method. We have more data for the examination of the results obtained by the Method of Melting Ice, however, and such an examination may be desirable. A comparison may readily be made by reference to the determinations made of the Specific Heats of Platinum, Silver and Zinc, for which all three methods have been employed. It is seen that, although some variations exist in the values found by the Method of Mixtures, as employed by different investigators, they are very evidently higher than those obtained by the Method of Melting Ice as applied by use of Bunsen's Ice Calorimeter. The values found by use of the Method of Condensation by Mr. Joly are also higher than those obtained by the Bunsen Calorimeter. It is improbable that the results obtained by so many skilful investigators, applying the Method of Mixtures with considerable variations at different times, their results sustained by an entirely different method, that of Condensation, should be incorrect, while those obtained by the few investigators who have used the Bunsen Ice Calorimeter should be correct.

The fact that the Specific Heats of most metals increase as their temperatures rise leads us to another consideration, namely, whether determinations made at temperatures varying greatly as to their proximity to the melting points of the various metals are properly comparable. This can be made clear only by the work of those investigators who have examined the variations in the Specific Heats of the metals up to their melting points.

It will be observed that if we select a few of the Specific Heats most probably accurate, namely those of Aluminium, .2236, Bismuth, .0303, Copper, .0947, Gold .0316, Iron, .1130, Lead, .0310, Platinum .0326, Silver, .0574, and Tin, .0545 and multiply by the Atomic Weights corresponding, the mean of the Atomic Heats thus found is 6.2444. The mean Atomic Heat of the whole series is slightly lower than this value.

[Abstract of Thesis presented to the Faculty of Princeton College for the degree of Doctor of Philosophy, June, 1896.]

REVIEWS OF BOOKS.

THE HIGHER CRITICISM OF THE PENTATEUCH. By William Henry Green, D.D., LL.D., Professor of Oriental and Old Testament Literature in Princeton Theological Seminary. New York. Charles Scribner's Sons, 1895. 8° pp. vii, 178.

THE UNITY OF THE BOOK OF GENESIS. By William Henry Green, D.D., LL.D., Professor of Oriental and Old Testament Literature in Princeton Theological Seminary. New York. Charles Scribner's Sons, 1895. 8° pp. x, 583.

The two latest publications of Dr. Green, though companion-volumes, differ considerably in aim and character. The Higher Criticism of the Pentateuch is a brief popular treatise in which the history, methods, conclusions, the religious and theological tendencies of the prevailing criticism are lucidly set forth in their most general outlines. It addresses itself to the public at large and requires no scientific acquaintance with the subject to be understood. At the same time, the reader will feel at each step that the discussion is in the hands of a master, and that only thorough familiarity with the minutest details could have produced the ease and assurance with which the subject is handled. In The Unity of the Book of Genesis, on the other hand, the author exhibits by patient study of section after section and by a careful testing of the critical views in regard to each, the solid basis of facts on which the generalizations of the briefer volume rests.

At the basis of his criticism of the modern view, Dr. Green lays a positive argument in favor of the unity of the Pentateuch. This argument takes for its point of departure a rapid survey of the history of O. T. revelation. It is shown that the organic structure of the Old Testament, as it offers itself to us, presupposes the Mosaic legislation, and that the historical framework of the Pentateuch is so inseparable therefrom as to compel the assumption of a common origin. Dr. Green further explains how all the component parts of the Testament are strictly subordinated to and in harmony with its place and purpose within the Biblical organism. The choice of this position for a point of attack upon the critical hypothesis offers a double advantage. In the first place, it furnishes the key to the solution of by far the greater part of the literary and historical difficulties with which the critics claim the traditional view of the Testament is beset. Dr. Green is able to show that, his theory of revelation being accepted and consistently applied, the difficulties disappear and all the facts fall into line. And secondly, the fascination which the latest phase of criticism seems to possess, is undoubtedly due to its bold attempt to press all the phenomena of the O. T. into the service of one great constructive idea. By only emphasizing and carrying out the conception of an organic revelation, to the needs of which all parts of the Scriptures are harmoniously subservient, the charm of the critical hypothesis may be offset by that of a scheme even more attractive in its grandeur and simplicity.

Next the arguments in favor of the Mosaic authorship are formulated succinctly but with great force and clearness. The critics are accustomed to refer to these under the comprehensive and somewhat depreciating title of tradition. Tradition in this case includes the testimony of the whole O. T., the N. T. and, in the latter, of none less than Christ, of a large part of the Pentateuch itself, as well as of the Jewish and the Christian church, and this by no means according to conservative claims merely but, to a large extent, on the admission of the critics themselves. The objections that will invalidate this mass of the most weighty testimony must surely be insurmountable. Dr. Green groups them under four heads: (1) Ana-

chronisms, inconsistencies, incongruities; (2) obviously composite origin; (3) clearly recognizable development of the law passing through several stages; (4) disregard of the law in preexilic history. Of these four the second group is examined at some length in the fourth chapter, which may be safely pronounced a model of critical discussion and which for keenness, cogency and exhaustiveness within such narrow limits, surpasses everything yet written on the subject on the conservative side. The author shows how all the phenomena on which the claim of composite authorship is based admit of satisfactory explanation. But he goes further than this by applying a sort of immanent criticism to the modern theory, and contending that, notwithstanding the utmost license enjoyed by the critics in adjusting their own criteria, in choosing their own division, in neutralizing contrary-evidence by inferences from their own hypothesis, and in thus making out the best possible case for themselves, they nevertheless have not been able to build up a consistent theory. Even to the finest manipulation the material will not yield everywhere. In numerous instances the divisive critics are forced to unreasonable assumptions. Especially the Redactor refuses to be made an intelligent agent. The numerous operations which the critics are compelled to ascribe to him do not reveal any plan or principle. The various sets of criteria, by aid of which the documents have been disentangled, are far from concurrent. The literary characteristics of the assumed writers, though originally obtained on the basis of the alternate use of the names Elohim and Jehovah in certain long sections, are yet found to clash with the use of these names in other sections. The resultant documents are not continuous notwithstanding the fact that in numerous instances the critics reason from isolated clauses as if no lost material had been connected with them originally.

In the Unity of the Book of Genesis these inner defects of the critical hypothesis are exposed in detail, each section being examined in regard to the first two groups of alleged evidence of composite authorship mentioned above. It would be a mistake to think that Dr. Green's argument in this part of the discussion is of force only to those who, with us, believe in the Mosaic origin of the Pentateuch. We discredit the critical theory, whatever one may be inclined to accept in its place. We do not see how an unprejudiced reader can fail to perceive that the critical structure rests on altogether too precarious ground to be accepted even as approximately probable. One might be tempted to go further than this and draw from Dr. Green's reasoning the conclusion, that, if the Pentateuch actually originated as the critics suppose, the very conditions of its origin render every attempted analysis of its component parts highly problematic. The much-vaunted agreement of the critics among themselves is no evidence to the contrary. As Dr. Green well says: "The consensus of divisive critics settles not the truth of the hypothesis, but what they consider its most plausible and defensible form. The partition of the Pentateuch is a definite problem with certain data, to which any solution that is offered must adapt itself. Experiments without number have been made to ascertain the practicability of this partition and what lines of division offer the best chance of success. . . . And the present agreement of critics, so far as it goes, indicates what is believed to be the most practicable mode of carrying out the hypothesis that has yet been devised." (Unity of the Pentateuch, p. 130.)

The concluding pages of the Unity of the Pentateuch are devoted to an inquiry into the religious and theological bearings of the dispute. Dr. Green proves that the modern view destroys the historic credibility of the Biblical record and presup-

poses the origin of the O. T. religion from naturalistic sources. He reminds us that in point of fact the most prominent advocates of this style of criticism have been until recently, pronounced anti-supernaturalists. Finally he explains how the tenets of the dominant school rendered the same service against the cause of revealed religion which at one time the now antiquated Deistic and vulgar Rationalistic style of thinking were made to render. The documents are placed at so great a distance from the events that ample room is allowed for the development of those legendary traits which the Biblical records present as miracles, or dated so late that the most extraordinary disclosures of revealed truth can appear as the result of natural growth and the most marvellous instances of prediction as vaticinia ex eventu. To a far larger extent also than is commonly supposed, the naturalistic taint inheres not merely in the results of this criticism, but in its very method and principles of investigation, whence they vitiate the whole process. As Dr. Green tersely expresses it, the pernicious tendencies are inwrought in its whole texture from beginning to end.

There is one point of view from which the conservative theory regarding the O. T. appears at an immense advantage over its modern rival. If both may for a moment, and for argument's sake, be called hypotheses experimenting with the Biblical material, the conservative view alone accepts and uses this material as it is without reconstruction, whereas the critics are compelled to make it tractable by a manipulation, which is in reality an inference from their hypotheses, and in so far disqualifies it for establishing the same. The critics themselves admit that the traditional theory is firmly embedded in the Biblical records, and that the latter have been shaped into accordance with it by later hands throughout. This virtually amounts to saying that the critical hypothesis is by limitations in its very nature doomed to remain within the sphere of the barely possible, and can never be raised into that of the demonstrably actual. The extent to which it has been compelled to draw the large masses of historical evidence into the range its reconstructive theorizing has hardly left anything unmanipulated available for the purpose of verification. If this circumstance makes it difficult to disprove the theory by historical evidence, it involves for the critics the more serious drawback of rendering their scheme incapable of objective proof. It may be safely left to the sober judgment of intelligent people to determine the claims to scientific acceptance of a theory which proceeds on the principle, that the facts, though at present contradicting it at each stage of experiment, ought not to be admitted as contrary evidence, because on the hypothesis itself the facts have been meddled with. Unfortunately, in the sphere of literary criticism, such a claim is not a-priori excluded, as it is in the province of physical science, by the inviolability of the facts. But nobody will be foolish enough to accept the bare possibility of its truth or the unlimited need of the critics to resort to it as sufficient evidence of its substantiality. On the contrary, each new hypothetical assertion of this kind encumbers and endangers the chief hypothesis which it is intended to bolster up.

GERHARDUS VOS.

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PRESIDENT CLEVELAND'S SPEECH.

Mr. President and Ladies and Gentlemen:

As those in different occupations and with different training each see most plainly in the same landscape view those features which are the most nearly related to their several habitual environments; so, in our contemplation of an event or an occasion, each individual especially observes and appreciates, in the light his mode of thought supplies, such of its features and incidents as are most in harmony with his mental situation.

To-day, while all of us warmly share the general enthusiasm and felicitation which pervade this assemblage, I am sure its various suggestions and meanings assume a prominence in our respective fields of mental vision, dependent upon their relation to our experience and condition. Those charged with the management and direction of the educational advantages of this noble institution most plainly see, with well-earned satisfaction, proofs of its growth and usefulness and its enhanced opportunities for doing good. The graduate of Princeton sees first the evidence of a greater glory and prestige that have come to his *alma mater* and the added honor thence reflected upon himself, while those still within her student halls see most prominently the promise of an increased dignity which awaits their graduation from Princeton University.

But there are others here, not of the family of Princeton, who see, with an interest not to be outdone, the signs of her triumphs on the fields of higher education, and the part she has taken during her long and glorious career in the elevation and betterment of a great people.

Among these I take an humble place; and as I yield to the influences of this occasion, I cannot resist the train of thought which especially reminds me of the promise of national safety and the guaranty of the permanence of our free institutions which may and ought to radiate from the universities and colleges scattered throughout our land.

Obviously a Government resting upon the will and universal suffrage of the people has no anchorage except in the people's intelligence. While the advantages of a collegiate education are by no means necessary to good citizenship, yet the college graduate, found everywhere, cannot smother his opportunities to teach his fellow countrymen and influence them for good, nor hide his talents in a napkin, without recreancy to a trust.

In a nation like ours, charged with the care of numerous and widely varied interests, a spirit of conservatism and toleration is absolutely essential. A collegiate training, the study of principles unvexed

by distracting and misleading influences, and a correct apprehension of the theories upon which our Republic is established, ought to constitute the college graduate a constant monitor, warning against popular rashness and excess.

The character of our institutions and our national self-interest require that a feeling of sincere brotherhood and a disposition to unite in mutual endeavor should pervade our people. Our scheme of government in its beginning was based upon this sentiment, and its interruption has never failed and can never fail to grievously menace our national health. Who can better caution against passion and bitterness than those who know by thought and study their baneful consequences and who are themselves within the noble brotherhood of higher education?

There are natural laws and economic truths which command implicit obedience, and which should unalterably fix the bounds of wholesome popular discussion, and the limits of political strife. The knowledge gained in our universities and colleges would be sadly deficient if its beneficiaries were unable to recognize and point out to their fellow-citizens these truths and natural laws, and to teach the mischievous futility of their non-observance or attempted violation.

The activity of our people and their restless desire to gather to themselves especial benefits and advantages lead to the growth of an unconfessed tendency to regard their Government as the giver of private gifts, and to look upon the agencies for its administration as the distributors of official places and preferment. Those who in university or college have had an opportunity to study the mission of our institutions, and who, in the light of history, have learned the danger to a people of their neglect of the patriotic care they owe the national life entrusted to their keeping, should be well fitted to constantly admonish their fellow-citizens that the usefulness and beneficence of their plan of government can only be preserved through their unselfish and loving support, and their contented willingness to accept in full return the peace, protection and opportunity which it impartially bestows.

Not more surely do the rules of honesty and good faith fix the standard of individual character in a community than do these same rules determine the character and standing of a nation in the world of civilization. Neither the glitter of its power, nor the tinsel of its commercial prosperity, nor the gaudy show of its people's wealth, can conceal the cankering rust of national dishonesty and cover the meanness of national bad faith. A constant stream of thoughtful, educated men should come from our universities and colleges preaching national honor and integrity, and teaching that a belief in the necessity of national obedience to the laws of God is not born of superstition.

I do not forget the practical necessity of political parties, nor do I deny their desirability. I recognize wholesome differences of opinion touching legitimate governmental policies, and would by no means control or limit the utmost freedom in their discussion. I have only attempted to suggest the important patriotic service which our institutions of higher education and their graduates are fitted to render to our people, in the enforcement of those immutable truths and fundamental principles which are related to our national condition, but should never be dragged into the field of political strife nor impressed into the service of partisan contention.

When the excitement of party warfare presses dangerously near our national safeguards, I would have the intelligent conservatism of our universities and colleges warn the contestants in impressive tones against the perils of a breach impos-

sible to repair. When popular discontent and passion are stimulated by the arts of designing partisans to a pitch perilously near to class hatred or sectional anger, I would have our universities and colleges sound the alarm in the name of American brotherhood and fraternal dependence.

When the attempt is made to delude the people into the belief that their suffrages can change the operation of natural laws, I would have our universities and colleges proclaim that those laws are inexorable and far removed from political control.

When selfish interest seeks undue private benefit through governmental aid, and public places are claimed as rewards of party service, I would have our universities and colleges persuade the people to a relinquishment of the demand for party spoils and exhort them to a disinterested and patriotic love of their Government for its own sake, and because in its true adjustment and unperverted operation it secures to every citizen his just share of the safety and prosperity it holds in store for all.

When a design is apparent to lure the people from their honest thoughts and to blind their eyes to the sad plight of national dishonor and bad faith, I would have Princeton University, panoplied in her patriotic traditions and glorious memories, and joined by all the other universities and colleges of our land, cry out against the infliction of this treacherous and fatal wound.

I would have the influence of these institutions on the side of religion and morality. I would have those they send out among the people not ashamed to acknowledge God, and to proclaim His interposition in the affairs of men, enjoining such obedience to His laws as makes manifest the path of national perpetuity and prosperity.

I hasten to concede the good already accomplished by our educated men in purifying and steadying political sentiment; but I hope I may be allowed to intimate my belief that their work in these directions would be easier and more useful if it were less spasmodic and occasional. The disposition of our people is such that while they may be inclined to distrust those who only on rare occasions come among them from an exclusiveness savoring of assumed superiority, they readily listen to those who exhibit a real fellowship and a friendly and habitual interest in all that concerns the common welfare. Such a condition of intimacy would, I believe, not only improve the general political atmosphere, but would vastly increase the influence of our universities and colleges in their efforts to prevent popular delusions or correct them before they reach an acute and dangerous stage.

I am certain, therefore, that a more constant and active participation in political affairs on the part of our men of education would be of the greatest possible value to our country.

It is exceedingly unfortunate that politics should be regarded in any quarter as an unclean thing, to be avoided by those claiming to be educated or respectable. It would be strange indeed if anything related to the administration of our Government or the welfare of our nation should be essentially degrading. I believe it is not a superstitious sentiment that leads to the conviction that God has watched over our national life from its beginning. Who will say that the things worthy of God's regard and fostering care are unworthy of the touch of the wisest and best of men?

I would have those sent out by our universities and colleges, not only the counsellors of their fellow countrymen, but the tribunes of the people—fully appreciating every condition that presses upon their daily life, sympathetic in every untoward

situation, quick and earnest in every effort to advance their happiness and welfare, and prompt and sturdy in the defence of all their rights.

I have but imperfectly expressed the thoughts to which I have not been able to deny utterance on an occasion so full of glad significance, and so pervaded by the atmosphere of patriotic aspiration. Born of these surroundings, the hope cannot be vain that the time is at hand when all our countrymen will more deeply appreciate the blessings of American citizenship, when their disinterested love of their Government will be quickened, when fanaticism and passion shall be banished from the field of politics, and when all our people, discarding every difference of condition or opportunity, will be seen under the banner of American brotherhood, marching steadily and unfalteringly on toward the bright heights of our national destiny.

THE SESQUICENTENNIAL CELEBRATION.

The desire to commemorate the 150th anniversary of the founding of the College of New Jersey, originated in the minds of some of the alumni several years ago, and was finally put into definite shape by a report presented to the Board of Trustees in February, 1895.

From this report it appeared that at last the idea of developing into a University, which had long been cherished, and the preparatory steps towards which had long since been taken, was to be openly advocated, and the plea made for the necessary funds to place the new foundation upon a permanent basis. The hopes of the committee have been largely realized.

It is not the intention of this article to anticipate the publication of the memorial volumes which are soon to appear, but simply to place on record in the BULLETIN an account of the various features of the occasion.

A portion of the celebration which was probably more thoroughly appreciated by the scholarly men of the nation, than by the general public, was the series of lectures which occupied the week previous to the celebration proper. They were to be considered as the more serious and truly university features of the occasion and were largely attended by the men of distinction in scientific, literary and philosophical circles throughout the country. These lectures were all delivered by men of distinction from the old world and might be considered the greeting of the best University thought, from the famous institutions across the ocean, to one of the oldest of the new world's schools of learning as she was about to take her full place in the higher ranks and assume her share of the university work of the future.

These lectures have been summarized for this number of the BULLETIN by members of the Faculty in the kindred departments which they represent.

On Tuesday, October 20th, at 10.30 a. m. the Trustees and Faculty, together with the delegates and invited guests assembled at Marquand Chapel, from which point they proceeded across the campus to Alexander Hall. Here the celebration was opened with a religious service.

The anthem, Veni Creator Spiritus, was rendered by a choir of alumni and then the invocation was made by Professor Fisher, the Dean of the Divinity School of Yale University. The one hundredth Psalm was then sung by the congregation, and Professor DeWitt of the Princeton Theological Seminary read the scriptures.

President Patton preached a sermon, historical in part, upon "Religion and the University," which seemed the keynote of the whole celebration. The Rev. Dr. Murray led in prayer, closing with the Lord's prayer in which all united.

Martin Luther's famous hymn "Ein' feste Burg ist unser Gott" was sung and followed by the benediction, which was pronounced by the Rev. Dr. W. B. Bodine, of Philadelphia.

The whole hall was again filled at 3 p. m. when the public reception of the delegates took place. Dr. Charles E. Green of the Board of Trustees, and chairman of the Sesquicentennial Committee, presided and made a few introductory remarks acknowledging the receipt of the many congratulatory addresses from institutions of learning throughout the United States and Europe. He then introduced the Rev. Dr. Howard Duffield, of New York City, who delivered the address of welcome on the part of Princeton to her guests.

Two responses were made to this address—one by President Eliot of Harvard University, in behalf of American Universities and Learned Societies, and the other by Professor J. J. Thomson of the University of Cambridge in behalf of the European Universities. This exercise being concluded the delegates adjourned to the Chancellor Green Library where they were presented to President Patton and Dr. Charles E. Green individually.

The library had been prepared for this reception by the removal of the desks and tables from the central room and the railing surrounding the alcoves had been decorated by placing upon it the framed congratulatory addresses which had been received from the different educational institutions.

Alexander Hall was filled to overflowing in the evening at 9 p. m. for the orchestral concert conducted by Mr. Walter Damrosch. Every number was well received, and at the close of Weber's "Jubilee Overture" as the orchestra played the portion known as "America" the whole audience arose with a storm of applause.

October 21st had been called the Alumni and Student Day—and so it turned out to be. Never before in the history of Princeton had such crowds poured into the place.

The exercises of the morning were preceded by a procession from Marquand Chapel to Alexander Hall. Governor Griggs of New Jersey presided and introduced the Rev. Dr. Henry Van Dyke of New York City, who represented the Cliosophic Society, and who delivered the poem of the occasion, entitled "The Builders." Professor Woodrow Wilson was next introduced. He represented the American Whig Society and the subject of his oration was "Princeton in the Nation's Service."

Two events of general interest, not in the official programme, took place in the afternoon.

The first was the presentation by the New Jersey "Society of the Sons of the Revolution" of a bronze tablet commemorating the connection of Nassau Hall and our early National history. Col. S. M. Dickinson, the president of the society, presented the memorial tablet in a short speech which was responded to by Dr. Charles E. Green on behalf of the Board of Trustees, accepting the gift. Then followed an address by the Hon. J. L. Cadwalader emphasizing the appropriateness of such a tablet upon the walls of the venerable college building, because of its importance in the revolution.

Later in the afternoon a football game between the teams of the University of Virginia and the Princeton eleven took place. The game was largely attended and as the play was open, it offered a good exhibition of the science of the game.

The evening was however the culminating point in the alumni and student participation. For several months the class secretaries and presidents had been in correspondence with their classes upon the subject of the torchlight procession which was to take place at this time.

Preparations had also been made by the committee for a general illumination and an exhibition of fireworks. At eight o'clock the alumni and undergraduates assembled in the main quadrangle where they formed in line for the procession. At 8.30 the line started upon its march. The 71st Regiment Band led, followed by the Marshal and his aides. Then the Mercer Blues formed the head of a column over a mile long. The formation consisted of columns of fours throughout. Following this company which was dressed in the style of the Old Colonial Company of Princeton in the revolution, came a body of students, 25 in number, who were sent to represent the undergraduates of Yale University. These were immediately followed by the undergraduates to the number of over 1,000. After this body came about 1,500 alumni by classes. With but two exceptions every class from 1839 down to the last class of 1896, was represented. "The Old Guard" consisted of all classes before 1860. After that date the classes were separated into divisions by decades, each of which was put under a distinct leader.

The line of march was to University Place, along Dickinson Street to the grounds of the Theological Seminary. Here the Seminary students had formed in double column on either side of the main roadway through their campus and welcomed the procession. When the College column had passed through their ranks the Seminary students fell in line and followed the procession in their line of march. The line next passed around the Little Triangle, then down Nassau Street, about a mile. After this they countermarched to Washington Street, thence along McCosh Walk back of the two Halls, in front of West College and Reunion Hall and then past the reviewing stand in front of Nassau Hall.

After the procession had passed in review before the President of the United States, student songs were sung by the Alumni and Undergraduates.

During these exercises the Campus was illuminated with orange-colored lanterns and Nassau Hall was outlined with orange electric lights. The evening was brought to a close by a brilliant display of fireworks.

Thursday, October 22d, the Sesquicentennial Anniversary day, was a fitting sequel to the two days which preceded it. The closing exercises were marked by especial dignity and impressiveness. Never, in this country at least, had there been such an assembly of distinguished men at any University celebration. When the procession headed by the President of the United States and President Patton entered the already crowded Hall, the audience rose and gave the President such an ovation as has been seldom witnessed. A brief but most impressive prayer was offered by the Rev. Dr. Theodore L. Cuyler of Brooklyn. President Patton then announced the University Title and the new endowments which had been received, both being welcomed with long continued applause.

After this came the conferring of Honorary Degrees. Over seventy distinguished men were presented for the highest degrees in Laws, Divinity, etc., before the Presidential chair, and were most heartily greeted by the audience. After the formal conferring of the honors had been ended and the recipients of the Degrees had taken their seats upon the platform again, the President of the United States was introduced. This was the signal for another outburst, every one in the large audience rising and the cheering being continued for several minutes. The address which is published in full in this number of the BULLETIN, was warmly received and its sentiments most heartily endorsed by every one present. The audience all joined in singing the American National Hymn, after which the Right Rev. Henry Yates

Satterlee, the Bishop of Washington, pronounced the Benediction.

The Faculty and invited guests were then asked to lunch with the President and Mrs. Cleveland by President and Mrs. Patton at Prospect. Later in the afternoon a reception was given to the President and Mrs. Cleveland, which was largely attended.

In the evening two events took place. The general visitors were entertained by a concert given by the Glee Club in Alexander Hall. The official guests of the College and the benefactors of the institution were invited to attend a dinner given in Assembly Hall. At the close of the dinner, Dr. Charles E. Green, who presided, introduced Mr. Henri Moissan, who brought a greeting from the French Academy. The regular toasts of the evening were responded to as follows:

Theology, by Professor G. P. Fisher.
Philosophy, by Professor A. Seth.
Jurisprudence, Hon. W. B. Hornblower.
Mathematics, by Professor Felix Klein.
Physical Sciences, by Professor A. A. W. Hubrecht.
History, by Professor Goldwin Smith.
Literature, by Professor Edward Dowden.

Commissioner Harris made the final address on the subject of University Education, which was followed by a farewell word by President Patton.

Thus closed a period of three days of festival celebration which were full of pleasant occurrences. Everything favored, the weather was at its best; our Alumni were present in large numbers and took part enthusiastically in every event. Never before have so many Princeton men assembled to do honor to their Alma Mater, never before has such general and deep devotion been exhibited, and never were the words AVE and SALVE inscribed on the memorial arches fuller of welcome and meaning for the future of Princeton.

PROF. J. J. THOMSON'S LECTURES.

The subject of Prof. Thomson's lectures was the Electrical Discharge in Gases, a subject in which the lecturer is an acknowledged master, both from his extensive knowledge of the work that has been done by others and from his own investigations. Speaking generally, the lectures contained an account of the various methods for rendering a gas a conductor of electricity and of the laws of gaseous conduction. The particular matters connected with the discharge in high vacua were not treated. It is understood that a large amount of material prepared by the lecturer was not given, owing to lack of time, but that it will appear when the lectures are published.

The lectures opened with a brief discussion of the validity of the equations of Maxwell's theory when applied to the ether, and of the peculiar questions which arise when they are applied to electrolytes and especially to gases. The difficulty of charging a gas with electricity was then mentioned, and several ways of overcoming that difficulty described. Thus, gases may be charged when rapidly evolved by electrolysis from strongly acid solutions, by the presence of a red-hot wire, by the presence of the electric arc, by allowing water to fall in drops and break on a metallic plate.

Gases ordinarily are non-conductors, but they may be made conductors, in some cases by simply heating them, by the passage of the electric spark through them, or by exposing them to the Roentgen rays. An aluminium bulb was used, through which dried and filtered gas was passed; the gas in the bulb was traversed by the Roentgen rays and when it was subsequently led between the two surfaces of a charged condenser, it was found to act as a conductor and to gradually discharge the condenser.

The remainder of the lectures was devoted to the examination of the conductivity of gases in the conditions just described. A theoretical formula was found on the hypothesis that the conduction is electrolytic, which was consistent in the main with the results of observation.

The lectures were attended by a number of the undergraduates and graduate students who were especially interested in physics, by the professors of the university and by many professors of mathematics and physics in other institutions. Among these may be mentioned Professor Mendenhall of Worcester Polytechnic Institute, Dr. G. W. Hill, Professor Hastings of Yale, Professor Webster of Clark, Professor Hale of the Yerkes Observatory, Professor Anthony, Professor Rosa and Professor Crawford of Wesleyan, Professor Olds of Amherst, Professor Crew of the Northwestern University, Professor Partridge of the Central Manual Training School, Philadelphia, and Professor Halsted of the University of Texas.

PROF. DOWDEN'S LECTURES.

The Spencer Trask lectures by Prof. Edward Dowden, of Dublin University, attracted a fine audience, by the high reputation of the lecturer and also by the interest of his subject, "The French Revolution and English Literature." The field traversed, though not wholly new, has not before received so systematic treatment. We are glad to know that these lectures will be published in due time. They were given in Alexander Hall, beginning Monday afternoon, October 12, and were six in all.

The first lecture was necessarily general in character and explanatory of the method adopted in handling the subject. It was specially interesting in showing the side-lights thrown on any literary development by history and philosophy. After reviewing the literary tendencies in the pro-revolutionary period, the lecturer pointed out factors of the revolutionary period, such as the scientific movement, the simplification of manners, strongly moulding its literature.

In his second lecture Prof. Dowden discussed certain "theorists of the Revolution," William Godwin and Mary Wollstonecraft (afterwards Mrs. Godwin). This lecture was mainly occupied in an analysis of their works, especially the "Inquiry Concerning Political Justice" and the "Vindication of the Rights of Woman."

The third lecture was wholly occupied in the discussion of Edmund Burke. His attitude as an opponent of all the ideas underlying the French Revolution was outlined and his theory of government was fully presented. Along with this a clear analysis of Burke's personality and character was given.

Burns, Southey and Coleridge were the authors treated in the fourth lecture. The influence of the revolutionary ideas on the works of these men was clearly and forcibly pointed out, both in the emotional and intellectual aspect of their writings.

The fifth lecture was occupied with Wordsworth. After dwelling on the poet's earlier sympathy with revolutionary thought, the lecturer traced the reaction which took place in Wordsworth's mind. He took pains to clear up some misconceptions of the poet's character, especially that he was before all else a quiet, simple, benign being, with little or no passion in his make-up. Prof. Dowden has been a close student of Wordsworth as of Shelley, and his estimate of the *man* Wordsworth was thoroughly complete.

The closing lecture discussed Landor, Byron and Shelley, dwelling specially on the last-named poet. The lecturer traced the influence of Godwin on Shelley at some length. His studies of the poet gave a marked glow to his treatment. He

quoted from himself a passage, which admirably condensed his views of Shelley's genius, as that genius was affected by the revolutionary doctrines.

The Trask lectures have never been so well illustrated in their province as part of our University life as in these lectures of Prof. Dowden. They were among the most marked features of our sesquicentennial celebration.

PROFESSOR HUBRECHT'S LECTURE.

The Descent of the Primates, viz. of that order of Mammals in which not only the monkeys, but also Man himself, were brought together by Linnaeus already more than 150 years ago, was the subject of the lecture of October 19. Whereas this order has been looked upon, in a general way, not only as the most highly developed of the animal kingdom, but also as the latest to make its appearance on the surface of the earth, arguments were here brought forward to show that already in the Eocene period true Primates occurred, which possessed many distinguishing features, that up to very lately were held to be quite peculiar to man. These peculiar features are found in the very earliest stages of individual development, but they are so characteristic, that they oblige us henceforth to draw a very distinct line, separating the Primates from the Lemurs, an order of mammals which was erroneously supposed to occupy a place in the pedigree of man and monkeys, and which for that reason has sometimes been designated by the name of *Prosimiae*. In determining the affinities between man and his ancestors of the Eocene and of the Mesozoic periods Embryology was largely drawn upon and it was shown that its results coincided in a most unexpected measure with those of Palaeontology. The early embryonic development of Tarsius spectrum, a rare mammal found in the Indian Archipelago, whither Professor Hubrecht had gone five years ago to study its ontogenetic history, was now sufficiently known, thanks to a very complete series that had gradually been collected and worked out. It was shown how in many important details Tarsius can be compared to man, how in many others it resembles the Insectivorous mammals, which must have been represented by more flourishing orders in the Mesozoic period.

Special attention was called to a fossil mammal from the Eocene, discovered and figured by Professor E. D. Cope under the suggestive name of *Anaptomorphus homunculus* and which, though closely allied to Tarsius, shows in its dentition unmistakable points of greater resemblance to man and the anthropoid apes.

The pedigree of man can thus be considerably shortened up: during the whole of the Tertiary period his ancestors have most probably been distinct from those of the present monkeys, and fresh discoveries amongst Mesozoic Mammals must be awaited to clear up the exact relation of the order of Primates to other Mammals.

A similar shortening up of the pedigree of the whole sub-class of placental Mammals was attempted, by showing that their descent from oviparous Amphibia is more in accordance with the observed facts of palaeontology, comparative anatomy and embryology, than their more circuitous descent from egg-laying reptiles.

PROF. BRUGMANN'S LECTURE.

In choosing the problem of noun genders as the topic for his lecture, Prof. Brugmann had two objects in view. His aim was to show the present status of investigation in this field, and likewise to illustrate by a concrete example the difference between the modern scientific methods of linguistic research and those of the begin-

ning of this century. The discussion had an added interest from the fact that the present-day theories in regard to noun genders are due directly to Prof. Brugmann himself. He was the first to apply to the solution of the problem a correct method and a sound judgment of the historical facts of the languages. His investigations were begun in 1875 and published only after the most careful consideration in 1888, in *Techmers Zeitschrift*. In 1891 he contributed a second article to Paul and Braune's *Beiträge*, in response to an attack by G. Roethe, and established so firmly his position, that the older views of Grimm and Humboldt have been given up once and for all. Each new discovery as to use and meaning of suffixes has helped to confirm Prof. Brugmann's views.

The question is, how did our pro-ethnic ancestors come to assign a gender, masculine or feminine, to every abstract notion or sexless object? Jacob Grimm sought the cause in the creative imagination of the uncultivated prehistoric peoples who saw in every lifeless object masculine or feminine characteristics. They personified and sexualized every noun-concept. Strength, size, activity constituted masculine attributes, their opposites feminine. Prof. Brugmann shows that Grimm's view is in contradiction to what we know of the mental development of men and peoples, and contravenes the *facts* of language. Nouns denoting objects characterized by strength, size, &c., refuse at every turn to come into the proper category. In short, it is altogether probable that the grammatical gender of nouns had nothing whatever to do with the natural gender. Epicene nouns such as ὁ μῦς "the mouse," ἡ ἀλώπηξ "the fox," go to show this; as also the fact that nouns so often change their gender in the historical period of a language. For example *Traube, Niere*, &c., which in Middle High German are masculine, in New High German are feminine, under the influence of *Erde, Ehre*, &c. Again, even where there was personification, as in ὕπνος "Sleep," θάνατος "Death," which were regarded as masculine deities, the primitive imagination did not create this gender, but simply made use of the grammatical gender *which already existed.*

The whole problem of grammatical gender depends for its solution on the original meaning of the "feminine" -ā- and -iē- (-ī-) [=gr. -ια] stems. That -o- had originally no specifically masculine force is shown by its use in neuters, as in gr. ζυγόν lat. jugum. The other suffixes, like -i-, -u-, -ter-, &c., expressed in themselves from the earliest times, no gender distinctions. Even the so-called feminine -ā- cannot have had originally any feminine significance but was probably, as Joh. Schmidt has shown, used to form abstracts and collectives. Nor can -iē- (-ī-) be proved to have been primitively a feminine suffix. These facts demonstrate definitely that masculine and feminine as grammatical genders did not in the everyday speech of the people call up the least notion of a natural gender. Prof. Brugmann outlined further the manner in which the -ā- and -iē- (-ī-) suffixes probably acquired their feminine signification, viz.: from their use in stems like **mā̆mā* and **genā* where the root itself contained the feminine meaning. It is a common phenomenon in the Indo-Eur. languages that a suffix, no matter what its original significance, acquires an additional shade of meaning from a root or roots with which it is used. When such a suffix becomes "productive" it carries with it to the new words it helps to form its newly acquired force. The -ā- for example, obtained its feminine force from words like **mā̆mā*, and was used by the side of the -o- suffix to distinguish sex in the names for animate beings. The -o- stem became masculine by contrast with the feminine -ā-. Except in the case of animate beings

the -ā- or -iē- stem had no connection with natural gender. Latin *anima* is not a feminine in the same sense as Latin *dea* is feminine, nor is Latin *animus* a masculine in the same manner as Latin *deus*. Prof. Brugmann closed his lecture with a tribute of praise to William Dwight Whitney, who did so much towards the introduction of the newer methods into the study of Comparative Philology. Special stress was laid upon the fact that Whitney was one of the very first to insist that the phenomena of the pro-ethnic language must be explained in accordance with the laws operating in modern languages.

PROF. SETH'S LECTURES.

Two philosophical lectures were delivered in Alexander Hall on Friday and Saturday preceding the Sesquicentennial exercises by Prof. Andrew Seth, of the University of Edinburgh. Prof. Seth was introduced to a large and appreciative audience by Dr. Shields, and before his lecture he gave a few introductory remarks, expressing his gratification in coming to Princeton as a representative of the great Scottish university, inasmuch as the names of Witherspoon and McCosh had associated Scotland and Princeton by ties strong and enduring. The first lecture was largely an historical sketch of the modern philosophical thought in the two opposite tendencies toward universalism, individualism and the seventeenth century being characterized by the former and the eighteenth century by the latter type of philosophy. The deistic implications on the one hand, and the pantheistic on the other in these two tendencies were discussed, and the essential features of a theistic system in contrast were outlined—Kant's contribution to the speculative thought of the nineteenth century was especially emphasized. His categories of reason as principles of knowledge, and the category of oughtness as the fundamental principle of ethics with the postulates of freedom, God, and immortality make possible a theistic philosophy that is neither deism nor pantheism. The modification of the Kantian principles by the universalistic tendencies of Hegel was also discussed.

In the second lecture Hegelianism was subjected to a detailed criticism whose force bore especially upon Hegel's virtual suppression of the finite personality and the reduction of all being to the self-manifestation of the absolute. Prof. Seth took the position that in the theory of being the will must be made central. A theory of being cannot be merely a theory of knowledge, but must take account of the will, which in the finite personality must be a realization of the individual will and not of the absolute. In a similar manner also he criticized Bradley's exposition of Hegelianism in his "Appearance and Reality," and entered a sharp protest against the absorption of the finite in the all-fulness of the absolute. Prof. Seth maintained both the transcendence and the immanence of the absolute as essential to the theistic position, and as a necessary implication, the distinct personality of the individual, ever dependent upon, yet never lost in, the absolute. Prof. Seth's criticism was throughout fair, consistent and searching. His thought was presented in a literary form that gave color and warmth to his discourse, and his fervent words left the impression that he spoke not merely as a philosopher, but also as a prophet in the sense of one who interprets the deep things of God.

PROFESSOR KLEIN'S LECTURES.

A course of four lectures on the Theory of the Top was delivered in Princeton during the week preceding the sesquicentennial by Professor Felix Klein, of the University of Göttingen. The audi-

ence which listened to these lectures consisted of several scientists and professors in this and neighboring universities, some of whom had been pupils of Prof. Klein in Germany; of certain undergraduates pursuing mathematical studies, who had been attending courses given during the previous month preparatory to these lectures; and of those who were drawn to hear one whom fame asserted to be the greatest mathematical teacher of the day.

The subject-matter of the lectures was divided into four parts: the geometric introduction, the dynamic relations, the general analytic discussion when the independent variable is complex, the toy top with moving point.

First of all, the double system of coördinates used in considering the problem of the rotation of a body about an axis with one point fixed was considered. As the leading expounder to-day of the ideas of Riemann it was evidently fitting that Professor Klein should use the transformations of the system derived from the stereographic projection of the points of the sphere, rather than the systems employed by Euler, or the system which may be designated as the quaternian system. In the beginning the transformations are expressed much more symmetrically in these latter systems, but the problem is not one which is symmetrical, since the body rotates about one axis. And it would therefore seem (as the result shows) that the system of stereographic projection, which considers one line as distinguished from all others, should be superior, and that the expressions for this movement will have a kind of symmetry in this system. Moreover, such a system has been used with great power by the French writers, notably Darboux. It was especially emphasized that, in this system of parameters, the parameters, as well as the magnitude ordinarily called the variable, are functions of the time.

Since these parameters are complex numbers, and are functions of t, the analytic problem which naturally emerges is to consider the rotation as depending upon a complex variable t.

In considering the dynamical question, it was noted that the simple movement under consideration was a Poinsot movement, and then the equations of Lagrange were introduced. It is only by the inversion of the integrals that the problem can be solved, and this has been done by the methods of Jacobi. These considerations will be much simplified by the use of the parameters here introduced, and by the use of the Riemann method of conform representation, by means of which the parameters can be expressed as quotients of sigma-functions, which may be called multiplicative elliptic functions. In the same way the curve on the sphere about the point of the top, which may be called the polhode, is a multiplicative elliptic function, as is also the herpolhode.

By means of the diagram of a Riemann surface on a sphere the functions of a complex t were represented, and the determination of this surface was explained by taking a system of spheres with portions of this surface drawn upon each sphere.

Poinsot was the first to show that the top moving on a plane leads to hyperelliptic functions, but in the dynamic problem in hand Jacobi's method of inversion involves many difficulties of calculation. Professor Klein closed his lectures with the introduction of the expressions for the parameters in terms of the automorphic prime functions, as these are better adapted to the purpose of inversion than the functions of Jacobi.

In an address before a special meeting of the American Mathematical Society, held in Princeton on Saturday, October 17, Professor Klein continued his contribution to the subject in considering the question of the stability of the sleeping top.

ARTICLES UPON PRINCETON IN THE PERIODICALS.

The Sesquicentennial Celebration in October succeeded in holding a very considerable share of public attention, notwithstanding the fact that the Presidential campaign was then nearing its culmination. The daily press throughout the country devoted much of its space to the proceedings in Princeton, and the notable address of President Cleveland invested the occasion with a truly national importance. In addition to these daily reports the magazines and the weekly papers contained a number of articles relating to Princeton. Some six of the more important of these articles will be briefly mentioned here.

Harper's Weekly, under date of October 24, printed an article entitled "The Princeton Celebration," and written by Prof. William M. Sloane. In this article the early history of Princeton is traced, and particularly the strong political influence exerted by its founders and its early graduates. This bit of history is followed by a delineation of the educational policy of Princeton, and its bearings upon the moot questions in higher and professional education. The sketch closes with an outline of the lectures which preceded the celebration and with an exposition of the program of events that marked the celebration itself. The accompanying illustrations, especially the one of the illumination of Nassau Hall, were happily conceived and executed.

In the *Outlook* for October 31 there appeared over the signature of Dr. Henry van Dyke a contribution headed "Princeton, 1746–1896." Dr. van Dyke traces the origin of the College to the "Great Awakening" in the first half of the last century, and to the stimulus which that religious movement imparted to the education of the clergy. The formative work of Princeton men in the Constitutional Convention is next described, after which the significance of the pioneer educational work of Princeton in founding new colleges prior to 1810 is set forth. The article then proceeds to an analysis of the results of the administration of Dr. McCosh, and concludes with depicting the character of our voluntary student organizations, such as the Halls and the Philadelphian Society, in whose constitution Dr. van Dyke thinks the true inwardness of our college life is best revealed.

The *Critic* of October 24 published an article by Professor Winthrop M. Daniels upon "Princeton Traditions and Tendencies." The intellectual life of Princeton is represented as characterized by three dominant modes of thinking—the political, the theological and the philosophical. The first era extended from Witherspoon's accession down to the beginning of the present century; the second down to the advent of Dr. McCosh in 1868, and the third is that which prevails at present. The present leanings of the various departments of study are also portrayed.

To the *Forum* for October Professor John Grier Hibben contributes a paper on "Princeton College and Patriotism." In this contribution the early political struggles of Princeton men are traced in the Mecklenburg Declaration of Independence, in the Revolutionary struggle, in the Constitutional Convention and in the Civil War. The number of our alumni who attained civil eminence is detailed, and a very imposing list it makes. The recent sesquicentennial oration of Professor Woodrow Wilson appeared in the last number of the *Forum*.

The October number of the *Review of Reviews* had an article by Professor Daniels on "Princeton After One Hundred and Fifty Years." This article is devoted largely to an exposition of the expansion of the College, and of Princeton's educational system, in both graduate and

undergraduate departments. It touches also upon the administration of discipline, and concludes with a consideration of the prospects for the development of Princeton University.

LORD KELVIN'S JUBILEE.

The celebration of the fiftieth anniversary of Lord Kelvin's appointment as a professor in the University of Glasgow was in every way a most impressive academic affair. The most distinguished scientific men on both sides of the Atlantic were gathered together to pay honor to the great physicist, and perhaps the most interesting part of the whole function was the great modesty and simplicity of Lord Kelvin in the midst of the brilliant company that had come together to do him honor.

The ceremonies lasted through two days and were of a very simple and dignified character. On the evening of the first day there was a reception held in the University building, at which, not only all strangers, but all of Lord Kelvin's friends and admirers in Great Britain, had an opportunity to pay their respects to him in a gracious and thoroughly informal way. In one of the rooms of the University all of Lord Kelvin's inventions were set out upon a portentously long table, and one of the interesting incidents of the evening was Lord Kelvin's reception of telegraphic congratulations, sent practically round the world by means of one of his own useful inventions. It was difficult to realize at sight of so many admirable instruments of practical use that Lord Kelvin was even more distinguished in the history of theory than in the history of invention.

On the morning of the second day there were exercises in the public hall of the University at which appropriate addresses were made—one of them by Lord Kelvin himself—and at which the congratulatory addresses of the various universities and learned societies represented at the celebration were presented to him by the distinguished men delegated for the purpose. Each delegate spoke a few words of appreciation as he presented the address with which he was entrusted and then shook hands with Lord Kelvin and made way for the next delegate. On this occasion, also, eight or ten honorary degrees were conferred upon some of the most distinguished men of science present, among others upon Professor Simon Newcomb of Johns Hopkins University. After these morning exercises the delegates were photographed in a group at the main door of entrance to the University building, Lord Kelvin sitting in their midst, with Lady Kelvin standing directly beside him.

In the evening of the same day the corporation of the city of Glasgow gave a public banquet to Lord Kelvin, in all respects a most brilliant affair, and enlivened by speeches which were more than ordinarily pointed and interesting. Lord Kelvin himself spoke again in response to the toast of his health, and, by way of expressing his own feelings with regard to the whole celebration, confessed a sense of failure rather than success, such as only a really great and simple man could have afforded to utter under such circumstances.

The last feature of the celebration was a sail to the Kyles of Bute for the purpose of affording the delegates an opportunity of seeing the most beautiful features of the region with which Lord Kelvin's life had been identified.

The celebration, as a whole, was worthy of the great University which undertook it and of the reputation of Lord Kelvin.

Principal Caird was, to the universal regret, prevented from being present by serious ill-health, and one of the singular consequences of his absence was that Lord Kelvin himself, as the senior professor, conferred the honorary degrees at the public exercises by designation of the Univer-

sity law. Occasion was taken to confer a degree upon Lord Kelvin, and that degree had, under the circumstances, to be conferred by the professor second in seniority.

No one who had the good fortune to be present can easily forget the hospitality of the University, or the unique personal interest of the occasion.

The following is the address sent by Princeton University and delivered through the hands of Professor Woodrow Wilson:

To John Caird, Principal and Vice-Chancellor of the University. Sir James Bell, Lord Provost of Glasgow:

The faculty of Princeton University desire to express to you their hearty congratulations on the occasion of the Jubilee of your most eminent Professor and Citizen, Lord Kelvin.

We cannot here recount all his arduous labors in Science nor his many services in behalf of humanity; we are not unaware, however, that he has explored the entire domain of Physical Science and illustrated its several provinces by the light of his genius. Mechanics, Molecular Physics and the Physics of the Ether have been essentially reformed and enriched by him. Preëminent in his power of penetration and unrivalled in his skilful employment of mathematics as a means of investigation, he has rightfully come to a foremost place in the ranks of scientific men. Nor is this all the man has achieved whom we delight to join with you in honoring. In every laboratory where Science is prosecuted instruments of precision which his genius has devised are familiar appliances and are indispensable. To him the world largely owes the fact that we can outstrip time and annihilate space in our greetings across the seas.

But more, and better than all else, you have in Lord Kelvin a shining example of a noble nature and of a kindly heart. We should be untrue to ourselves did we not invoke the blessing of Heaven to the end that, with health restored, he may long continue to abide with you, adding new lustre to your ancient University.

FRANCIS L. PATTON.

Princeton, New Jersey, May, 1896.

PURIFICATION OF WATER BY DISTILLATION.

By G. A. HULETT.

Ordinary distilled water suffices for almost all analytical purposes, but for atomic weight work and many operations in physics, water of a higher degree of purity is required. There seems to be little definite information as to apparatus and methods. Stas distilled his water from an alkaline solution of potassium permanganate after rejecting $\frac{1}{20}$, but still found ammonia. After distilling from potassium bisulphate and condensing in a platinum condenser he finds it wholly free from organic and mineral matter. Kohlrausch*, in preparing pure water, used potassium permanganate, potassium hydroxide and potassium bisulphate, in order to get rid of organic matter, volatile acids and ammonia; while Nernst† suggests purifying water by recrystallization.

In the present investigation the apparatus used possesses some points of advantage over that ordinarily employed. The condenser is a platinum tube 19 mm. in diameter, and about 60 cm. long. At the lower end the tube is contracted to 5 mm. diameter, and bent so as to pass into the neck of the receiving flask, thus preventing the distillate from coming in contact with the air about the still. This platinum condenser is provided with a short glass cooler, leaving about 20 cm. of the upper end free. About 15 cm. of the free end extends into the neck of a 4-liter retort, and the space between the platinum and glass is packed with asbestos. By this arrangement *only the water which*

*Pogg. AA, Erg. Bd. 8 p. 4.
†Wied. Ann. 44,583 note.

is condensed in the platinum tube is collected, while the water which condenses in the neck of the retort drips out at the asbestos packing.

When there were more than two liters of the liquid to distil it was found convenient to siphon water into the retort as fast as it distilled. If it was necessary to reject the first portion of the distillate the larger portion, in a glass flask, can be boiled the desired length of time before the siphon is started. With this arrangement it is possible to distil large quantities of water and the apparatus needs no attention for hours at a time.

The most simple and delicate test for the purity of water is its electrical conductivity, which can be determined by the method employed by Kohlrausch. The cell was of the single bottle form, and the electrodes were each 25 cms. They had the form of concentric cylinders three mm. apart, and held in place by little pieces of glass fused to the lower ends. The resistance capacity of this cell was determined by comparing it with another of known resistance capacity, and also by using a $\frac{1}{1000}$ normal sodium-chloride solution.

	I		II	
	Time in Min.	$K10^{10}$	Time in Min.	$K10^{10}$
1st (100 cm.³)	·	10.8	8	3.75
2nd "	12	6.78	6	4.11
3rd "	11	4.85	7	1.58
4th "	10	3.68	6	1.25
5th "	9	4.03	6	.77
6th "	8	3.20	7	.96
7th "	16	2.93	16	.76
8th "				
9th "				
10th "	25	2.20	26	.76
11th "				
12th "			9	.76
13th "	26	1.63		
14th "			28	.74
15th "	18	1.46		
16th "				
17th "	10	1.40	25	.87
18th "	8	1.47		

	III		IV		V	
	Time in Min.	$K10^{10}$	Time in Min.	$K10^{10}$	Time in Min.	$K10^{10}$
1st (100 cm.³)	12	3.01	15	4.44	30	1.17
2nd "	10	1.40	24	1 67	18	31.0
3rd "	8	.88	18	.99	9	102.0
4th "	9	.76	21	.79	9	3.01
5th "	9	.76	16	.80	13	2.90
6th "			15	.80	14	3.93
7th "	10	.76	11	.79	20	47.9
8th "			12	.76		
9th "	30	.72	7	.77	23	6.80
10th "			7	.76		
11th "	12	.71	6	.76		
12th "	14	.71	6		60	22.10
13th "	11	.72	6	.76		
14th "	24	.72	6	.77		
15th "						
16th "	26	.76				
17th "						
18th "	16	.78	8	.78		

Its value was found to be 1148.10—10. Repeated determination showed an experimental error of 0.5%. This cell gave a very sharp telephone minimum when used with pure water.

In general 2 liters of the water to be in-

vestigated were put into the retort, and the distillate collected in 100 c.c. flasks, so that successive portions of the distillate could be tested. The first water investigated was from a surface well and an analysis by Mr. McLauchlan showed it to be unfit for drinking purposes. Two liters of this water were distilled, and the successive portions of the distillate gave the conductivities indicated in column 1 of the table, p. 96. It appears that after ¼ has been distilled over, the remainder is quite good water. Following this suggestion and using the continuous distillation, 15 liters of water were obtained with a conductivity $K \times 10^{10} = 3.3$. This water was then made distinctly purple with potassium permanganate, and after standing two days was acidulated with 75 cubic cm. of sulphuric acid, and carefully redistilled. Finally 2000 c. c. were treated with 50 c. c. of a saturated solution of barium hydroxide, and again distilled. The conductivity for the successive portions of this final distillate are shown in column 2. It is to be observed that the conductivity of the successive portions of the distillate decreases rapidly and after about 25 % of the water has been distilled it reaches the value $K \times 10^{10} = 0.77$, where it remains practically constant during the remainder of the distillation. It is to be further observed that the distillation may be continued without affecting the quality of the distillate until only about 100 c.c. of the liquid are left in the retort.

A second series of observations was made, starting with distilled water used in the laboratory. 10 liters of this was water mixed with 50 c.c. of a saturated solution of potassium bichromate and 50 cubic c. m. of sulphuric acid, were allowed to stand several days and then distilled. (The acid solution of potassium bichromate is a much stronger oxydizing agent than potassium permanganate, and seems to boil with less bumping. Two liters of the distillate were mixed with 50 c. c. of the barium hydroxide solution. The results are shown in column No. 3 of the table, and are in close agreement with those in No. 2. It thus appears that the method here described yields distilled water which leaves nothing to be desired as far as any impurity affecting the conductivity is concerned. It needs to be added that repeated distillations of this final distillate did not lead to any reduction of the conductivity below 0.76. Kohlrausch concludes from his research that the best water distilled in the air has a conductivity of 0.70.

Barium hydroxide is a strong base, and seems to be an admirable reagent for retaining the carbon dioxide and volatile acids. The results show no indication of barium hydroxide having been mechanically carried over during the distillation. To further test this point 2 liters of the best water with 50 cubic 3 c.c. of the solution of barium hydroxide were distilled at a slow rate until the distillate showed a conductivity $K \times 10^{10} = 0.76$, and then the rate of distillation was gradually increased until it was 17 c.c. per minute. The results are found in column 4. Comparing these results with those in 2 and 3, it appears that the quality of *the water is independent of the rate of distillation*, when barium hydroxide is employed to fix the acid. Even the last 100 cubic 3 c.c. gave a conductivity of $K \times 10^{10} = 0.87$, leaving only 55 c.c. in the retort.

With sulphuric acid, however, the case is altogether different, as appears from the following series of observations: Two liters of water, conductivity of $K \times 10^{10} = 0.80$, and 50 cubic 3 c.c. of sulphuric acid were slowly distilled. All portions of the distillate gave high conductivities, as shown in column 5. A portion of the distillate was concentrated, and when tested with barium chloride, showed sulphuric acid. An inspection of these irregular results

suggests that some of the liquid in the retort was mechanically carried over. But as all portions of the distillate show a conductivity markedly above that of the water employed (0.80) it raises the question whether some sulphuric acid does not distil over with the water? In order to test the quality of water to be had by the method of continuous distillation 5 liters of the distillate from potassium bichromate and sulphuric acid were divided between the retort and a 3-liter glass flask, from which it could be slowly siphoned into the retort. After rejecting the first 400 c.c. of the distillate, during which time the water in the flask was also boiled, the siphon was started and two liters of the distillate collected. The sample showed $K \times 10^{10} = 0.87$. The next liter gave 0.78. Then successive hundred distillations gave respectively: 0.76, 0.80 and 0.87, leaving but 100 c.c. in the retort. It is possible that a tin tube of the same construction would answer for water. According to A. C. McGregory, a condenser of good glass answers every purpose.

[*Journal of Chemical Physics*, Sept., 1896.]

SUMMARY OF ARTICLES BY MR. ERNEST LUDLOW BOGART.

Mr. Bogart, sometime South East Club University Fellow in Social Science, has recently published summaries of two researches which he prosecuted this last year in Princeton. The first of these papers was read last winter before the Politics Club of the University, and has recently appeared translated into German, in the October number of Conrad's *Jahrbücher für Nationaloekonomie und Statistik*. The article in question is entitled *Die Entstehung und Bedeutung der Volkspartei in den Vereinigten Staaten*. The origin of the Populist party is historically traced to its root in the Farmers' Alliance. Its growth is explained by the consolidation of agricultural interests with industrial organizations of artisans. The platform of the new party is dissected and explained, with especial reference to the subjects of taxation, trusts and finance. The ultimate reason for the rapid extension of the power of the Populist party is ascribed to the prevalence of agricultural discontent, itself mainly the outcome of the fall in the world's price of cereals. The paper closes with an outline of the political status of the Populists prior to the late election, the result of which is accurately predicted.

The second paper entitled "Financial Procedure in the State Legislatures" appeared in the September number of the *Annals of the American Academy of Political and Social Science*. This article is in reality but an abstract of a larger work which is the basis of Mr. Bogart's projected thesis for the degree of Doctor of Philosophy in the University of Halle, Germany. This study was based upon a comparison of the parliamentary processes in vogue in our commonwealth legislatures in raising revenue and appropriating the same to various public purposes. The data upon which Mr. Bogart bases his conclusions were obtained first, from a careful and comprehensive study of all the statutes of all the States bearing upon this subject, and second, from special inquiries directed to the heads of the finance departments of the States. The inquiry very properly excludes questions of State or local taxation, or administrative problems connected therewith, and confines itself to the study of committee government in matters of State finance. The article in question is supplemented by a number of tables which present in convenient shape the usages of the various States in the matter of revenue legislation.

THE SESQUICENTENNIAL MEMORIAL MEDAL.

At a meeting of the Sesquicentennial Celebration Committee held in February, 1895, it was decided to issue a memorial medal. Accordingly the work was put in the hands of Mr. Thomas Shields Clarke, of the class of 1882, to make a series of studies of Nassau Hall, which it was decided was to form the subject for the face of the medal. It was resolved that a Latin inscription should be placed on the back of the medal. Mr. Clarke completed his clay model, of nearly eleven inches in diameter, and from it made a plaster cast, which was then sent to the United States Mint in Philadelphia and reduced on a pair of dies three inches in diameter, under the superintendence of Mr. Charles E. Barber, of the engraving department of the Mint. Two proof medals were then struck in bronze and proved entirely satisfactory. The medals were then struck off, one copy in pure gold, thirty copies in silver and five hundred copies in bronze. The Mint also arranged for making cases for the medals. Each case was nearly five inches square and was lined on the inside with black velvet with a touch of orange velvet edging. The Latin inscription on the back together with the words on the face is so arranged as to bring in the College of New Jersey, Nassau Hall, Princeton University, the date 1896 and the statement of the change of title. The lettering is done in capitals of the Augustan period. Translated into English it reads:

"What was once the College of New Jersey, now fulfils one hundred and fifty years, and as Princeton University beholds a new age."

Above the inscription is placed, in a Roman bracket, the earliest motto of Princeton: "Dei sub numine viget."

REVIEWS OF BOOKS.

American Meditative Lyrics. By Theodore W. Hunt, Ph.D., Litt.D., Professor of English in Princeton University. pp. 205. E. B. Treat, New York, 1896.

The purpose of this little volume, Professor Hunt says in his preface, is "to discuss American lyrical verse with exclusive reference to its meditative quality as distinct from any other features it may present in the line of a more objective and secular type of poetry." In an introductory chapter on the Spiritual Element in poetry the author defines the quality which he means to designate specially by the term meditative. It is the thoughtful and serious expression of the ethical and spiritual element in nature and human experience, that quality which relates the lyrical form of poetry so closely to the expression of the deeper religious sentiments and convictions of the human spirit. Professor Hunt singles out the lyric as the most characteristic product of American poetic genius. He says: "It is in this special province of lyrical verse that our American literature finds its most attractive and fruitful field, so that it would be difficult to collect a richer anthology of the idyllic order than that given us in any well-selected Lyrica Americana, while it is from this side of verse, mostly all, that the compass and excellence of our poetic product are to be judged." On the question of the relative merit of the lyric form, he says, the epic may surpass it in majesty of movement and a corresponding dignity and grandeur of effect, and the dramatic may surpass it on its tragic side in a sublime seriousness of manner or a bold and startling revelation of human sin and struggle, but neither of them is compara-

ble to it in that sweet and gracious influence it exerts over all human faculties and human feelings, in that subdued and softening impressiveness of which the restless spirit of humanity is in such urgent need."

The conspicuous quality of the meditative lyric is, he says, "its reflective tone and temper, that quiet and pensive order of verse which arises from the poet's undisturbed communings on God and man and human life and destiny and appeals directly and profoundly to the most intense experience of the reader." This meditative and spiritual type of the lyric as it manifests itself in our literature is the topic of Professor Hunt's book. He selects as its most conspicuous producers such names as Bryant, Longfellow, Emerson, Whittier, Poe, Bayard Taylor, Lowell, Holmes, and among the female poets Mrs. Stowe, to each of whom he devotes a chapter and points out the meditative quality of their lyrical productions.

It is impossible, in the limits which must be observed here, to follow Professor Hunt's characterization into detail. He finds in Bryant, especially in his forest hymns and elegies, a "rare combination of epic majesty and lyric tenderness, with impressive ethical teaching, indicating his dominating purpose to use his poetic gift for the ennobling of the moral nature of man." In Longfellow, the most perfect of born American bards, he finds the characteristic lyrical qualities to be perfection of poetic form, unaffected simplicity of moral and spiritual teaching, together with the natural expression of the friendliness of a good man, and the restful quality of his verse. In Emerson we find the same restful serenity of spirit. But Emerson carries the Hebraic element of sublimity to its highest level. He is a spiritual optimist, finding, like Wordsworth, a divine presence everywhere, and verging on a pantheistic conception of nature and man. He calls himself a Christian Theist. Professor Hunt characterizes his verse as Christianly theistic, and styles him "the real poet preacher of his time, 'approbated' to the ministry of right and truth." The meditative quality is found in Poe, though in a more intense and passionate form. Notwithstanding its morbidness, the dominating quality of Poe's lyrics is a cry for light and help while his life is plunging deeper into the darkness. Professor Hunt emphasises the purity of Poe's verse, it remaining in its spiritual quality, untainted by the evil of his life. In his perpetual unrest, and his inability to reach any solution of the great problems that are vexing his life, he is characterized as the Arthur Hugh Clough of American verse.

Whittier is the "Hebrew Prophet," the "Prophet bard," the "Hermit thrush" of our American song. In the clearness and trueness with which he voices right and duty, he is the poet of conscience. The author calls attention to the domesticity or homeness of Whittier's verse, comparing it in this respect with Burns's "Cotter's Saturday Night" or Allen Ramsey's "Gentle Shepherd." Lowell, "our New Theocritus," is characterized especially in his lyrics by the meditative tone and quality which, in his case, shows itself in a more distinctively scholarly and cultured tone than in any of his contemporaries. Holmes displays the least of this quality, but it is distinctively present in his verse. He is a "poet of man and human life." The great characteristic of his poetry as meditative, is its "mental and moral wholesomeness; its soundness, sanity and good sense; its conspicuous freedom from the morose, ascetic and revolting, and from those one-sided and hence defective views which mar the writing of so many gifted authors in modern prose and verse."

Comparing Lowell and Holmes with their older contemporaries, Professor Hunt

says: "Lowell and Holmes are less contemplative than the others, both in their personality and poetry, and Holmes the least of all. There is a spiritual fineness in Emerson not found in any of them, as there is a sweetness of temper in Whittier nowhere else discernible. If we may so express it, the meditative type of Holmes is that of a thoughtful man of the world as compared with the more introspective type of such a poet as Longfellow, while Lowell may fitly be called the scholarly observer of the morals and manners of men. His reflections are from the standpoint of educated sense and taste, and always presented in attractive form. He is, by way of excellence, the cultured thinker, never forgetting in his musings and moralizings that he is a man of letters at his study window."

Mrs. Stowe's right to a place in such distinguished company rests mainly on her uplifting devotional lyrics. She is selected as a representative of a class of poetesses who have enriched our lyrical poetry with some of its best examples. Among the later lyrical writers the names of Lanier, Aldrich and Stedman are distinguished, and to the last named an appreciative and deserved tribute is paid.

Professor Hunt says, in closing, of our literature, that "no literature of note has a richer record of lyric verse within the compass of a century, while no element of our developing poetic life is fuller of promise than this as to the excellence and permanence of our literary work. American literature has few great poets and few great poems. It has, however, a large amount of poetry that is thoroughly good —characterized by faith in God and faith in man, by faith in truth and right and love and spiritual law, and ministrant thereby to human life in its daily and deepest needs."

Notable features of Professor Hunt's book are the breadth and catholicity of its spirit, shown especially in the treatment of such writers as Emerson and Poe; the sureness and fineness of its literary judgments; the emphasis it places on the higher literary motives and the spiritual and ethical elements in poetry, and finally its style, which is a good model of what an academic composition ought to be.

A. T. Ormond.

Coppée and Maupassant, containing Le Morceau de Pain, Deux Pîtres, Un Vieux de la Vieille, Les Vices du Capitaine, Scénario, La Robe Blanche, Le Remplaçant, Un Enterrement Dramatique, La Vieille Tunique, La Peur, La Main, Garçon, un Bock! En Voyage, Apparition, Les Idées du Colonel, La Parure, Tombouctou. Edited with introductions, notes, and bibliography by A. Guyot Cameron, Ph.D., Assistant Professor of French in the Sheffield Scientific School of Yale University. Henry Holt & Co., New York.

Prof. Cameron has been as satisfactory again this time in his choice of texts as his previous publications led us to believe he would be. In the restless impatience of a changeful republic, short tales seem to appeal more and more to the popular mind in France and in the United States. Through Daudet French stories have won for themselves a place in American classrooms and the indications are that their use will be continued. If we sometimes wish for the ease and delicacy of "Les Étoiles" or of other gems of the "Lettres de mon Moulin" we can find at least much of their artistic touch in the selections Prof. Cameron has made from Coppée and Maupassant. Whether with the pathetic, which appears so feelingly in "Les Vices du Capitaine" or in "Le Remplaçant" or with that soft twilight tint that the poet Coppée so well knows how to stamp on his prose works, Coppée always appeals to the finer literary minds as well as to the people. But it is in "La Robe Blanche" that he is especially at home, in Paris, in

his favorite "Quartier Latin." He finds there a never failing source of study; every street and corner is in itself a picture or a poem in his mind. "En réalité," he says, la vie tout entière d'un observateur ne suffirait pas pour explorer à fond la monstrueuse capitale, dont chaque quartier, chaque rue même, a sa physionomie personnelle, son charactère original. La différence des types qu' on y rencontre est si tranchée que leur déplacement semble impossible. Quelle surprise pour le flâneur, s'il voyait un coulissier juif des environs de la Bourse traverser les paisibles cours de l'Institut!" What excites simply a little curiosity or ridicule in the narrow-minded *flâneur* would add interest and variety to the *physionomie personnelle* of a street scene for Coppée. The scenes that he depicts are not those that would have touched Maupassant. In "La Robe Blanche" he does not seek the realistic adjective that would have distinguished his little lame communicant from any other lame communicant in the world as Maupassant would have done. The picture he draws is not one that reminds us of the clear-cut portraits of Holbein whose brush, Coppée says, the scene would have tempted. Casting here and there a Dou-like ray of feeling light he gives the whole a poetic softness of touch so characteristic of him even when depicting the most sordid corner of the often seemingly characterless banlieue. And then in that well-chosen tale, the "Enterrement Dramatique," we can almost imagine the actors passing before our eyes as they pay their last respects to the dead, assuming an expression partaking, at the same time, of their theatrical rôle and of their ideal of a sincere mourner.

It is not an easy task to choose from Maupassant stories suitable for class-room reading, and happy as are the results in this case we are not quite sure that many sensitive-minded students would be benefited by the superstitious morbidness that prevails in one or two of the selections, as, for example, in the "Apparition." If it is true that a writer's characters represent the society with which he is most sympathetic, none of us would care to be introduced to Maupassant's circle. We regret it all the more because it is from one of the greatest novelists since Balzac that we are, at least in part, shut off. It seems to me suggestive when we consider that in the so-called Realistic School so few characters have been produced which stand the test of moral responsibility and also the fact that its aim is to describe human nature as they see it, pure and simple, ignoring, as far as possible, the motive or moral bearing of the action. Maupassant might not have been so pessimistic if he had given less attention to the purely materialistic and more to the psychological phenomena underlying the scenes he depicts. His pessimism is not one that would lead to progress; with no consolation in the past he sees hopeless annihilating death ahead, and that "terreur constante" as he terms it in the "Apparition" very frequently guides his pen.

However, the tales in this edition are quite free from that brutality which characterizes so many of Maupassant's works, and with the force and tensity of the master often show him at his best. With the clear and comprehensive lives of Coppée, and Maupassant and the suggestive notes with which he enlightens all his texts, Prof. Cameron has given us a volume well worthy to accompany his "Contes de Daudet."

W. U. Vreeland.

Carlyle's Essay on Robert Burns. Edited by Wilson Farrand, A.M., Newark, N. J. Longmans, Green & Co., New York and London, 1896.

Teachers and students of English are well aware of the great work that has recently been done and is now doing in the way of editing our English classics for the

use of secondary schools in preparing their pupils for college. In the efforts that have so happily resulted in establishing a system of uniform entrance requirements in English, no one has shown a more ardent and intelligent interest than Mr. Farrand, of the Newark Academy. It is, therefore, eminently fitting that in this specific work of editing our best prose authors and poets, he should take an active part, as he has done.

As stated in the preface, the editor's primary aim has been "to introduce the student to Carlyle and his works . . . and, also, to awaken an interest in the life and songs of Burns."

The plan or method of the editor is an admirable one, equally adapted to the needs of the teacher and the student.

By way of introduction, briefly presenting the facts as to Carlyle's life, writings and influence, and as to the Essay on Burns and Burns himself, the editor adds practical suggestions for teachers, including a valuable bibliography, specimen topics for written exercises, specimen examination questions and helpful chronological tables. Then follows the essay on Burns, to which is added the closing portion of Carlyle's "The Hero a Man of Letters," while the explanatory notes are sufficiently full to meet the needs of the class-room.

There are few, if, indeed, any, of Carlyle's essays in which, with all its errors, he is more decidedly himself as a man and a critic than in the Essay on Burns, and it would be well for modern students, whose only conception of Carlyle is that of a self-appointed and pitiless censor of men and books and institutions, to read with care this characteristic study of the ingenuous Scottish bard.

It is one of the merits of Mr. Farrand's edition that, in spite of what some readers might regard as an undue minuteness of suggestion, he has succeeded in allowing the author to speak for himself and in his own way. Carlyle is nothing if not Carlyle. The condensation of the material at the editor's command is to be especially commended, while the general style in which the subject matter is presented is clear and vigorous and distinctively literary.

In a word, the edition is a thoroughly good one, and is a striking illustration of what the teachers of our secondary schools are doing for the cause of higher English in America.

The series of which this volume is one is, moreover, a clear indication of the manner in which masters and professors are working together in modern education for the securing of the best results.

T. W. Hunt.

The series of College Histories of Art, edited by Prof. John C. Van Dyke, is now complete with the appearance of the History of Sculpture which Professors Marquand and Frothingham have prepared in collaboration.

The series is a notable one, produced as it has been by four American professors, who stand in the first rank of authorities upon their various subjects, and presents a striking contrast to the numerous Art histories published recently in Europe in which a single individual addresses himself to all branches of art in one or two cumbrous volumes and allows national bias to effect his judgment in all points where the art of his own country is concerned.

The History of Sculpture is designed as a text-book for the use of classes in general courses of art study in schools and colleges. The volume is of convenient size and form, it treats of the progress of plastic art through six thousand years of history from the sphinx at Gizeh in the Valley of the Nile to the present time. No country, no people is omitted that lays any claim to an historic develop-

ment in the art of sculpture save only Eastern and Southern Asia, the Saracens and the prehistoric semi-civilized tribes of our own hemisphere and these for good reasons given in the preface. It is by no means an easy task to condense the entire history of an important branch of art to text-book form under a single cover except by treating in vague outlines the more salient features of each period. This history, however, is far more than a series of sketches. Style after style is given a full and concise description, their mutual relations are clearly shown and all are linked together in harmonious historical sequence.

A treatment quite similar is given to each period or style throughout the book under the headings of conditions Physical, Political, Religious, etc.; Subjects, Materials, Methods and Conventions and most important of all Historical Development. This general scheme expands or contracts as necessity requires.

The sculpture of the ancient oriental civilizations is described on broad lines, the sculpture of a period being treated *in extenso* rather than by a series of individual monuments.

The plastic art of ancient Egypt is naturally the subject of the introductory chapter. Then follows the sculpture of Babylonia and Assyria. The authors, profiting by the most recent researches and discoveries in the East, have placed the date of the earliest remains of the former over a thousand years earlier than other historians. The antiquity of the remains found at Tello, the ancient Lagash, is thus made to vie with that of the art of the Ancient Empire in Egypt. Assyrian sculpture is shown to be the direct offspring of the Babylonian with many important characteristics of its own, while the Persian art is described as representing a fusion of Assyrian with Egyptian and even early Asiatic Greek influences.

The productions of the Hittites and Phoenicians, and Cypriote sculpture are introduced chiefly in connection with their influence upon other styles, particularly the early art of Greece.

Greek sculpture is treated with admirable breadth according to schools, though the more famous sculptors come in for a share of notice and individual monuments are more or less minutely described.

A brief review of the sculpture of pre-Roman Italy, Italic and Etruscan, a glance at Romanized Greek art and the decline of plastic art during early Christian and Byzantine times brings us to the middle ages.

Mediæval sculpture, rising in Italy, makes rapid advance in Southern France and reaches the apogee of its career in the 13th century sculptures of the Ile de France. The art of sculpture in Northern France greatly benefited by its alliance with the art of architecture under the Gothic period, a new motive, didactic or encyclopedic, inspired the sculptor. The productions of this time, though in no sense imitations, compare favorably in many respects with the developed Greek art of the 2nd half of the 5th century, B. C.

Under the Renaissance the palm is awarded to Italy, already rich in borrowed or imitated classic monuments. A host of names familiar and unfamiliar with hundreds of well known monuments are mentioned, their interrelations and the influence upon later art are pointed out.

Outside of Italy the Renaissance had a rather superficial significance. Great monuments were produced in France, Germany, England and Spain, but the Italian influence may be seen in most of them. The sculpture of the Revival following and imitating classic models at first and growing naturalistic as it developed became emotional and extravagant at its end.

Modern sculpture beginning with the 19th century returned to classic simplicity and has vibrated between this character on

the one hand and naturalism and realism on the other.

The history closes with a survey of the sculpture of the century in the various countries of Europe and in America, which being almost contemporary, and simply a result of past experience, cannot be historically treated. These chapters are scarcely more than lists of the more prominent artists and their chief works.

Well chosen and significent illustrations, mostly from photographs, embellish the volume from cover to cover. These serve not only to make the book attractive for popular reading but very useful as a book of reference. H. C. Butler.

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